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ABSTRACT

This teacher's guide encompassing the concepts found in the world of construction is designed for junior high school students, to be used as a total educational package with the textbook (VT 014 241) and the laboratory manuals (VT 014 242 and VT 014 243). As the first part of a 2-year integrated program in which the second year concerns manufacturing, it is designed to prepare students for enlightened citizenship and to provide educational-occupational guidance for the world of work. This program was designed to be used 45 minutes per day for 185 days, with 22 optional assignments for flexibility. Assignments cover three major areas: (1) analysis of the managed-personnel-production system of construction, (2) synthesis of housing construction practices, and (3) synthesis of city and regional planning practices. Each of the 185 assignment units contains objectives, time schedule, suggested demonstration and an overview. A list of teacher's aids, equipment and materials, a list of tools and equipment for students, a list of expendable materials and a scaled floor plan are appended. Three-ring binder format makes removal of pages easy. Other related documents are available as VT 014 088 and VT 014 238-VT 014 240. (GEB)

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THE WORLD OF
Construction

TEACHER'S GUIDE

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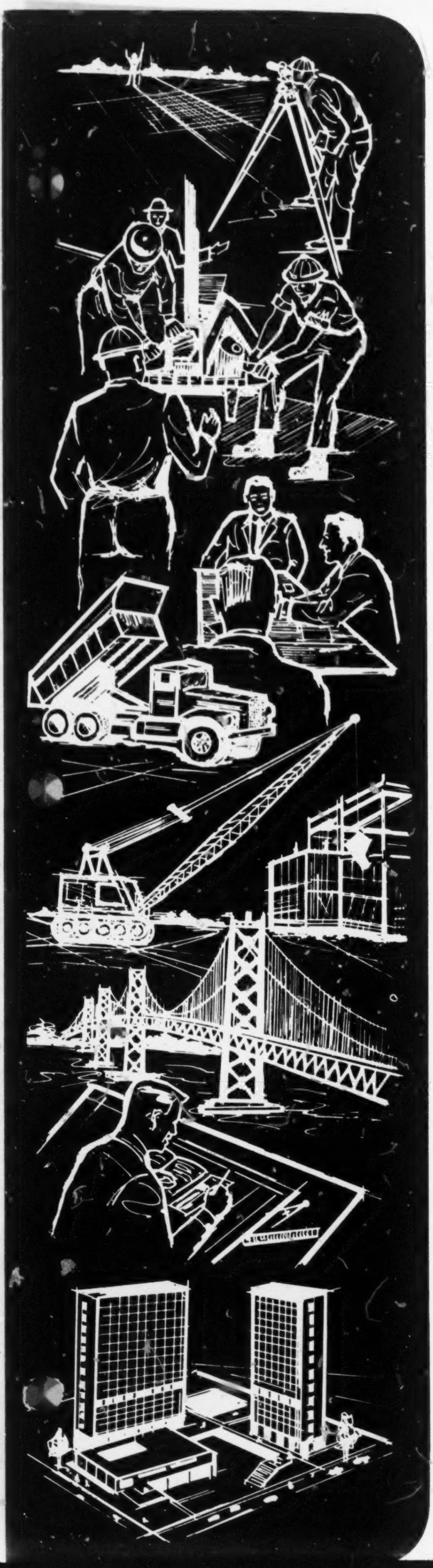

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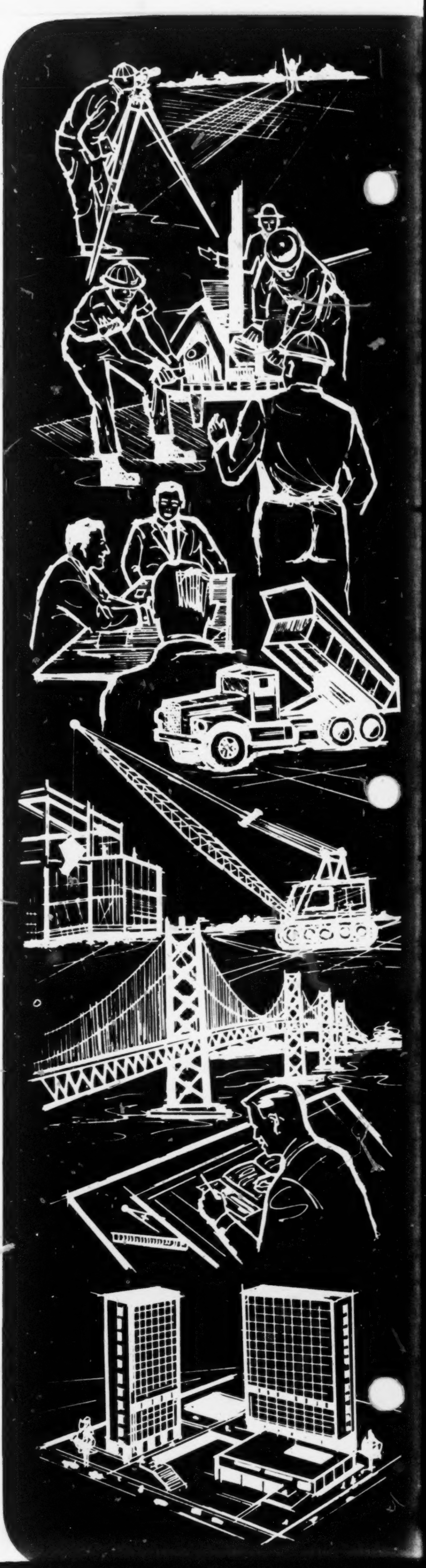

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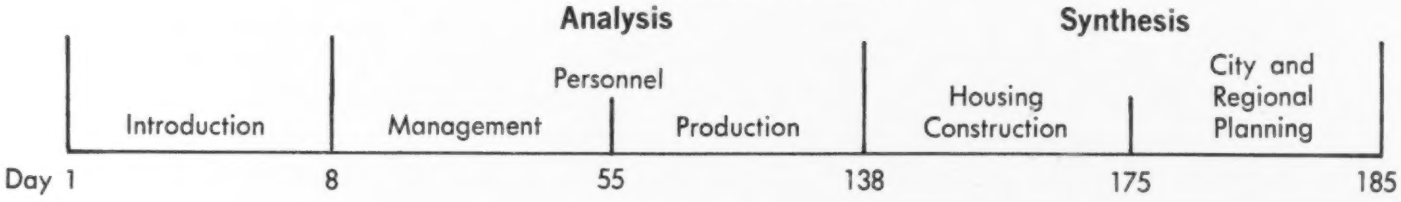
Explanation of Course Design and Instructional System

The World of Construction is a comprehensive and innovative one-year junior high school course in construction technology. Its instructional system is designed to prepare students for enlightened citizenship and to provide educational-occupational guidance for the world of work.

This is the first part of an integrated two-year program. The second-year course is in manufacturing technology. The two-course sequence is designed to provide an introductory study of industrial technology. In these courses, industry is defined as that subcategory of the economic system which substantially changes the form of materials in response to man's wants for material goods and services. Technology is defined as the knowledge of techniques. Industrial arts is defined as an organized study of the knowledge of techniques used in construction and in manufacture, or industry.

COURSE DESIGN



Course Continuum

This one-year course is divided into three major sections: an analysis of the managed-personnel-production system of construction, a synthesis of housing construction practices, and a synthesis of city and regional planning practices. The analysis of the managed-personnel-production system begins with an introduction to construction technology (8 assignments). Then management practices (47 assignments) and production practices (84 assignments) are described. Personnel practices are dispersed throughout the 131 assignments, wherever they are most relevant. The analysis section will provide a basic understanding of the common construction system for building any structure, whether it is a dam, building, tower, tunnel, bridge, utility network, or marine project.

The housing construction section (36 assignments) is a synthesis of construction practices applied to a specific structure: a house. Each student designs and builds his own model dream house or commercial housing, thus reinforcing knowledge of major construction practices. The city and regional planning section (11 assignments) introduces the impact of construction upon society and the effects of large scale and long range decision making.

Characteristics

The World of Construction is a total educational package. It provides the teacher with all that is needed to operate the program. Included in the package are: textbooks, Laboratory Manuals, a Teacher's Guide, achievement tests, course objectives, daily behavioral objectives, time schedules, lectures, demonstrations, discussion questions, procedures for laboratory management, safety precautions, lists of equipment, tools, expendable materials, special materials, and visual aids and devices.

The analysis of the managed-personnel-production system is characterized by a carefully structured body of knowledge which is presented in the textbook. The textbook is organized and structured to provide the student with a mental image of construction concepts. A companion Laboratory Manual provides the student with activities which reinforce each concept.

All learning experiences are designed to bring about carefully delineated behavioral changes in the cognitive, affective, and psychomotor domains. These behavioral changes which can be expected to result from reading, discussion, and laboratory performance are listed for each day of the course.

Textbook

The textbook was written by experts in the field of construction and was field tested and age graded by editors and junior high school teachers. It is organized and illustrated to provide the student with a conceptual framework for understanding construction technology. A conceptual model appears at the end of each reading to help the student understand the context and relationships of concepts he has read about. Thought-provoking review questions and listings of important words also are placed at the end of each reading.

All readings carry a number and should be read in sequence according to assignments listed in the Teacher's Guide table of contents. On the average, readings are assigned two or three times each week. The textbooks may be kept at home and are not required in the daily laboratory activity.

Laboratory Manual

The Laboratory Manual was developed and field tested by professional educators. All activities are designed to reinforce the concepts students have read about. The Laboratory Manuals are kept in the laboratory and should be used with each activity.

Activities are keyed with a number which corresponds to the reading number in the textbook. A letter beside an activity number indicates one of a series of activities related to a single reading assignment.

Teacher's Guide

The key to the operation of this program is the Teacher's Guide. The following focuses on the features of this guide.

A. **Table of Contents:** Upon examining the table of contents, you will find terms such as *optional, review,* and *test,* as well as reading titles. Since school years vary throughout the nation, 22 optional assignments have been built into the program. This makes it possible to fit the program to your particular school year. The number of days' difference between your school year and 185 days will determine how many optional days should be deleted from the course. Optional days are normally extensions of a preceding assignment or reviews and are desirable learning experiences, but they are not essential to gaining minimum coverage of the subject matter.

B. **Objectives:** Statements of behavioral objectives appear each day, related to the text, discussion, and laboratory activity. These statements of behavioral objectives are intended to suggest the evidences of learning on the part of the student. The instructional system for this program has been designed to facilitate the achievement of the daily behavioral objectives, which build toward the course objectives.

C. **Time Schedule:** Each 45-minute class period is divided into time allotments for the scheduled events. The time allotments are guides for pacing the coverage of the day's events.

DAILY SCHEDULE OF OPERATIONS

Homework		In Class Learning Experiences (45 min.)			
Reading	Review	Overview	Lecture or Demonstration	Discussion	Laboratory Activity

D. **Equipment and Supplies:** The equipment and supplies are listed for each teacher demonstration and student laboratory activity. Where equipment and supplies are listed "per teacher," the teacher needs that quantity for any number of classes. "Per class" means that each class needs that quantity. The teacher should multiply the number of classes he teaches by that number to get the total required. The quantity requirements are based on a class of 25 students. If a teacher has fewer or more than this per class, he must reduce or increase the quantity proportionally. Frequently a set or quantity of equipment and supplies is specified for a group of five students. To determine the quantity needed for a class, divide the number of students in the class by five: this figure is the number of sets of materials you need to supply for that class. The number of students per group can be increased to six or decreased to four to accommodate a particular class size. For maximum student participation, groups of four rather than six are recommended. Composite lists of all equipment and supplies for the course are found in the Appendices.

E. **Overview:** The overview provides a general digest of the important points of the text, what the teacher will talk about or demonstrate, what students should be able to answer in the discussion period, and what the students will do in the laboratory activity. The overview is written so that it can be presented verbatim to the students, or it can be paraphrased. The overview sets the learner's frame of reference for the day's learning experiences.

F. **Lecture and Demonstration:** This section provides the teacher with salient points to be expanded or clarified. A lecture is an expansion of some topic in the text and usually is closely related to what students will do in the laboratory activity. Many lectures and demonstrations include the use of visual aids such as transparencies or filmstrips.

G. **Discussion:** The purpose of the discussion period is to provide teachers with feedback evidence that information is being understood by the student. Therefore, questions are provided to be asked of students to determine the extent of understanding. Answers are provided to accommodate corrective feedback and reinforcement. The questions can be presented verbatim or paraphrased.

H. **Laboratory Activity:** This section provides the teacher with the management procedures necessary to direct the activity. Included are class arrangements, precautions, and suggestions for facilitating laboratory organization and operation.

I. **Safety:** Safety precautions are included in assignments where there may be dangerous conditions above and beyond normal laboratory operation. The teacher must use his own discretion in applying local safety regulations such as the wearing of safety goggles, fire drill procedures, use of equipment, and handling of materials. Safety precautions are noted in the Laboratory Manual where applicable.

J. **Laboratory Manual Answers:** The answers listed in this section correspond to the questions and problems requiring answers in the Laboratory Manual.

K. **Tests:** Five tests are scheduled in the first semester and five in the second semester. Each test follows a review day. The tests consist of approximately 35 multiple-choice questions. Approximately 35 minutes is allotted for each test, the remainder of the time being spent on reviewing the test questions as corrective feedback.

Objectives of Industrial Arts

A study of industrial arts serves these purposes:

1. Enables students to understand the concepts, principles, generalizations, problems, and strategies of industrial technology.
2. Encourages an interest in and an appreciation for industry as that element of the economic system that provides industrial material goods for the satisfaction of human wants for those goods.
3. Provides knowledge and skills that will be useful in life situations of occupational, recreational, consumer, and socio-cultural significance.

Objectives of the World of Construction

This course will enable the student to do the following:

1. Place construction technology in the broader context of industrial technology and all of technology.
2. Appreciate, understand, and perform selected management practices in planning, organizing, and controlling as they relate to construction production systems.
3. Appreciate, understand, and perform selected personnel practices as they relate to a managed production system in construction.
4. Appreciate, understand, and perform selected production practices in preprocessing, processing, and postprocessing or servicing as they apply to construction production systems.
5. Appreciate and understand the interrelationships within and between management, personnel, and production practices.
6. Appreciate and have some understanding of constructed projects and the tools and materials utilized in their construction.
7. Utilize knowledge of construction techniques outside the classroom, currently and in the future.
8. Understand the interrelationship of construction technology and community development.
9. Develop an awareness of vocations in construction technology.
10. Develop an awareness of the significance of construction technology in the past, present, and future.
11. Develop responsible and safe work attitudes and the ability to function as a member of a group.
12. Develop an awareness of self-realization and generate self-actuating behaviors.

ASSIGNMENT 1

Optional

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given an orientation by the instructor, state the teacher's name, the course title, the room number, and the weekly class schedule.

Time Schedule

10	Lecture
10–30	Discussion

Lecture (10)

1. If the first day is a full period, proceed to Assignment 3. In this event, you will not have used two optional days which are provided to account for the possibility of one or two shortened periods at the beginning of the school year. If you do not use these optional days, they may be used at your discretion later in the year.
2. If the first day is not a full period, you may use the shortened period to introduce yourself and to present the course title, the room number, and the weekly class schedule.

Discussion (10-30)

The balance of the time may be used for administrative matters and discussion.

Homework

None

ASSIGNMENT 2

Optional

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given an orientation to classroom procedures and policies,
    a. State the procedures in routine and emergency situations.
    b. Complete forms or provide information required for the class or school.

Time Schedule

10	Lecture
10–30	Discussion

Lecture (10)

1. If this second day is a full period, proceed to Assignment 3. In this event, you will have saved an optional day which may be used at your discretion later in the course.
2. If the second day is not a full period, you may use the shortened period to describe routine and emergency procedures such as those to be followed in the event of tardiness or of fire.

Discussion (10-30)

1. Additional time may be used for administrative matters and discussion.

Homework

None

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ASSIGNMENT 3

Introduction

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given the course organization and content:
    a. Name some of the student activities in the course.
    b. Name the two books they will use in the course and explain how, when, and where each is to be used.
    c. Define the term "concept" and state how concepts will be studied in this class.
    d. State what the homework assignment is, and how and when it should be done.

Time Schedule

5	Administrative Matters
20	Illustrated Lecture
15	Material Distribution
5	Discussion

Equipment and Supplies for Lecture

Equipment

1	filmstrip projector/screen

Supplies

1	Filmstrip 3, Introduction to *The World of Construction*
25 ea.	textbooks and Laboratory Manuals (for 25 students)

Administrative Matters (5)

If either or both of Assignments 1 and 2 were not used, you will need to use part of this period to make announcements and to dispose of administrative matters. If there are no administrative details, you will have additional time to introduce the course organization and content.

Illustrated Lecture (20)

(Introduce the course by emphasizing how students will learn in this course.) *A concept is a thought or idea.* This thought or idea forms a "mental image" or picture in your mind as well as in the minds of others. A concept can be communicated by a word, phrase, illustration, or gesture. For example, when I say the word "house," this has a meaning to each of you. Even though you have seen many houses, one-story or multilevel, white or green, large, small, brick or wood, landscaped or with no yard, in your mind you have generalized an idea of what is meant when you hear the word "house." Thus, we can communicate. The more houses you have seen and have had experience with, the more meaning and importance the word "house" has to you.

In this course you will learn about many concepts related to construction. The word "construction" has less meaning to you now than it will at the end of this course. The purpose of this course is to build your "mental images" of what construction is all about.

Your textbook will acquaint you with construction concepts. We will talk about these ideas in class. You will further enlarge your understanding of the concept by performing an activity which reinforces the concept. For example, if you read about the concept of "mixing concrete," you will mix concrete in class. You will put into practice what you have read and talked about, thereby making your concepts more complete and useable.

I will show you a filmstrip of some of the concepts you will be learning about in this course. (Show Filmstrip 3. You may want to tape-record the first lecture and play it back for the following classes.)

Introduction to The World of Construction

Script for Filmstrip 3—71 Frames

Frame No.

1. Focus.
2. The World of Construction
3. The World of Construction is a world of highways, skyscrapers, bridges, dams, utility networks, towers, tunnels, and other structures which are built on a site.
4. The first day in the laboratory you will study how improvements in tools and techniques have led to increased accuracy and productivity.
5. One of the first steps in the construction

of any project is to survey the site. These students are simulating an actual topographical survey.

6. After the land elevations are recorded, they are made into a topographical map.
7. Using the contour information on the topographical map, the students next move to the development of a plot plan.
8. Then the student develops a series of working drawings, the first of which is a foundation plan.
9. Sections and details are also made.
10. Working from the plans, students develop specifications.
11. After all the plans and specifications are made, the next step is to competitively bid for the project. These students are simulating the bidding process to determine which contractor gets the project award.
12. The award-winning contractor next needs to hire personnel. This student is acting as a personnel manager who is studying the job specifications of the men he needs to do the job.
13. Employer-employee interviews are conducted.
14. Happiness is being hired for a job!
15. After the work force is organized, the next task is the clearing of the site. These students are studying a model of the site plan to determine which are the most efficient practices for removing and/or salvaging various obstacles.
16. After the site is cleared, the students study the effectiveness of various earth-moving practices used in site development.
17. After the site is cleared, the structure is located on the site.
18. Some sites have existing structures on them which must be shored or stabilized. This student is studying ways of excavating while maintaining the stability of an existing structure.
19. Batter boards are next erected on the site to pinpoint the location of the foundation.
20. These students have built a form for concrete and are now preparing their reinforcing steel. One student is treating the form surface so that concrete will not stick to it.
21. Then it's time to get out the mortar box and dry-mix the concrete.
22. Then the concrete is wet-mixed.
23. A slump test is made to verify that the formula for the concrete meets the work specifications.
24. If the concrete passes the test, it is placed and screeded in the form.
25. Column forms are built on the footings and filled with concrete.
26. When the concrete is set, the forms are removed and cleaned.
27. Each student tries his hand at laying-up a concrete block foundation wall.
28. After the concrete is cured, the signalman directs his ironworking crew in the erection of structural steel.
29. This involves rigging and other standard ironworking practices, including safety precautions.
30. This ironworking team knows how to build a structural steel-reinforced skyscraper because, in their own way, they have built one.
31. Wood-framed structures are studied next, and this work crew is paying careful attention to the working drawings to get the sills, headers, and joists accurately placed.
32. A wall section is accurately constructed . . . .
33. raised into place, plumbed, and secured into position.
34. Roof trusses are fabricated and nailed into place.
35. Periodically throughout the course, the students role-play various situations taken from the world of work. Here the students are solving a grievance problem, following conventional construction industry labor-management practices.
36. With the rough frame up, utility systems are roughed in. The first of these to be fabricated and installed is the heating, air-conditioning and ventilating system.
37. After the ductwork is fabricated, the worker checks the structural plan to assure proper installation.
38. Then the ductwork is installed according to plan.
39. Plumbing and piping systems are the next to be fabricated and installed.
40. Both galvanized and copper plumbing are installed.
41. Next, electrical runs are laid out and holes are drilled in the framework.

42. Then junction boxes are installed.
43. These students have already installed their rigid conduit in the bottom of the box and are now installing flexible armored cable into another box entry.
44. Nonmetallic sheath cable also is installed in the electrical system.
45. This electrical subcontracting gang is hard at work trying to meet its production deadline.
46. Exterior sheathing is next cut to size.
47. Roofing felt is laid . . .
48. and then the shingles . . .
49. while part of the crew is installing siding.
50. Each student lays a course of brick . . .
51. and tries his hand at being a brick mason.
52. The work crew then applies drywall to the interior, . . .
53. tapes and finishes the seams, and sands off the rough edges.
54. Plaster is prepared . . .
55. and troweled onto another wall of their structure.
56. Everybody gets into the act. Note the drop cloth on the floor for ease of cleanup.
57. Periodically throughout the course, written achievement tests are administered.
58. Back to work with the installation of ceiling tile. . . . .
59 and the installation of flooring.
60. The window is trimmed. . . . .
61. and other finishing work is completed.
62. Both exterior and interior painting is done. . . . .
63. to complete the structure.
64. Then each student begins to envision a plan for his dream house.
65. He develops his plan into a 3-dimensional model.
66. The interest is intense, ...
67. as his dream house takes shape.
68. Individual differences are exemplified by the completed models.
69. Teams of students next compete in using their knowledge of construction technology in planning cities and regions.
70. Future citizens make decisions which affect their environments.
71. This ends the presentation on construction, but this program provides a background for a lifetime of intelligent participation in man's constructed world.

Material Distribution (15)

1. Distribute the textbooks and Laboratory Manuals, and explain how they are used. For example, in studying a concept the student reads about it out of class, answers some review questions and problems, and then performs some laboratory activities which further illustrate and explain the concept.
2. Explain that the textbooks are mainly used outside of class, and that the Laboratory Manuals are mainly used during class time and are stored in the laboratory.
3. Explain that if the homework is not completed on schedule, the students will not be fully prepared to do the related laboratory activities.
4. Assign *Reading 1* and the review questions and problems. Have students look at the text. Show them how it is arranged and what is expected as homework.
5. Do not try to organize the class today. This will be done during *Assignment 6*. You do need to provide storage for the Laboratory Manuals.
6. Have each student write his name on the front of the materials.
7. Store the Laboratory Manuals.

Discussion (5)

1. What are some of the activities you will perform in this class? (Activities shown in the filmstrip.)
2. What two books will you use in this course? (Textbook and Laboratory Manual for the course entitled *The World of Construction.*)
3. How are these books used? (The textbook is read out of class. The Laboratory Manual is used in class.)
4. What is a concept? (A notion or idea which forms a mental image in the mind, generalized from particular instances.)
5. How will we study concepts in this class? (Read about them. Talk about them. Perform activities representative of them.)
6. What is your homework assignment? (Reading 1.)

Homework

Reading 1

ASSIGNMENT 4, UNIT 1

Man and Technology

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to man and technology:
   a. Describe how *specialized tools* and technology lead to the development of an *economic system*
   b. Name three examples of materials which are:
      1) extracted
      2) reproduced
      3) constructed
      4) manufactured
   c. Explain the difference between a *constructed product* and a *manufactured product* and give three examples of each.

Discussion

2. Given Reading 1 and a lecture on man and technology:
   a. Identify industry as one part of economic technology.
   b. State why people specialize in their work.
   c. State what effect technology and specialization have upon our standard of living.

Laboratory Activity

3. Given a piece of wood, an electric drill, a hand drill, and a bow drill, drill holes correctly and compare efficiency.
4. Given time and cost charts, record, examine, and compare efficiency in relation to time and cost per hole.

Time Schedule

5	Overview
5	Lecture
5	Discussion
30	Laboratory Activity

Equipment and Supplies for Demonstration

The instructor will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	hand drill with 1/4" twist drill
1	bow and drill (approx. 1/4")
1	hand block for bow drill
1	C-clamp
1	watch with a second hand (from student)
1	portable electric drill with 1/4" twist drill
1	workbench with vise
5 pr.	safety glasses

Supplies (Group of 5)

2 pcs. 3/4" board (scrap)

Overview (5)

1. You have read that:
   a. Early man was very limited in what he could do. He had only one advantage over animals: he could think and outsmart them.
   b. Technology began when man began to use tools.
   c. Technology is defined as knowing how to use tools and techniques efficiently.
   d. We get materials in two basic ways: by extraction and by reproduction.
   e. We process materials into goods in two basic ways: by construction and by manufacture.
   f. The study of industrial arts is defined as the study of that part of the economic institution which substantially changes the form of materials to satisfy human wants for goods. It is the study of the processes, skills, techniques, and tools used to construct and manufacture.
2. Today I am going to tell you about technology and the specialization of work, and how these affect us.
3. I will demonstrate the use of a bow drill, hand drill, and electric drill.
4. You will then use these tools to find out which is the most efficient.

Lecture (5)

1. The development of technology gave added reasons for men to group together. Men could then divide up their responsi-

bilities. For example, some could make tools and others could use them for planting crops. Then others, knowing they would have food, could be free to devote their time to being tribal chiefs or doctors. The producers provided society with what became known as *economic* goods. The producers have developed our economic technology.

2. Man's economic goods are made, distributed, and consumed (used). We call this whole group of activities man's *economy.*
3. Technology is the knowledge of how to do something efficiently. Examples of technology are: (1) efficiently piloting a plane, (2) passing a law, (3) driving a nail, (4) pulling a tooth, or (5) keeping house.
4. Economic technology is the knowledge of how to produce and service economic goods.
5. Construction technology is part of economic technology; it is the knowledge of how to efficiently build and maintain structures which are built on the site where they are used. This course is a study of *construction technology.*
6. Man has continued to specialize. As construction technology increased, one man could not master it all. For example, an early pioneer usually planned and built his own log cabin. He learned how to do all the necessary work, from cutting down trees to making shingles for the roof. Today's builder, because of advanced construction technology, specializes in a certain type of work. It would be difficult for one person to be an architect, engineer, surveyor, electrician, plumber, mason, painter, roofer, and carpenter. Therefore, each person concentrates on specialized knowledge and skills and becomes more proficient in his work. As a result, people are able to have more and better goods and services. These eventually give us a higher standard of living.

Discussion (5)

The purpose of this discussion is to have the student express his comprehension of economic technology, specialization, and efficiency. The following questions may serve as a guide.

1. What will be studied in this course? (Construction technology: production of material goods and services.)
2. Why do people specialize in their work? (It increases efficiency.)
3. What effects do specialization and technology have upon our standard of living? (Together, they raise the standard of living. For example, there may be more time for recreation, more pay for work, shorter work days, and more products that lessen human labor.)

Laboratory Activity (30)

The students are to drill holes with three kinds of drills and time the operations. The timing will provide a basis for (1) determining the relative efficiency of the three drilling techniques and (2) estimating the cost per hole and the number of holes drilled per hour.

1. Demonstrate how to clamp a board.
2. Demonstrate the use of the hand drill, electric drill, and bow drill. (Limit the bow drill technique to 2 or 3 minutes.)
3. Explain how to record the drilling time and how to use both charts.
4. Assign students in groups of five to work stations.
5. If there are not enough drills for each group, have groups take turns with the ones available.

Safety Precautions

1. Be sure the piece being drilled is clamped securely.
2. Never place your hand behind the wood when drilling.
3. Never stand on a wet surface when using the electric drill.
4. Always wear safety glasses when using power tools.

Homework

Reading 2

Answers for Laboratory Manual

1. Electric drill.
2. Electric drill.
3. Bow drill.
4. Electric drill.

ASSIGNMENT 5, UNIT 2

Construction Technology

Objectives

As a result of their learning experiences, students should be able to do the following:

Text

1. Given information related to construction technology:
   a. Name the three main functions of management technology.
   b. Name the five main functions of personnel technology.
   c. Name the three main functions of production technology.

Discussion

2. Given the lecture and Reading 2:
   a. State why construction is a managed production system.
   b. Define construction technology.
   c. Name some examples of management, personnel, and production practices.

Time Schedule

5	Overview
5	Lecture
5	Discussion
30	Film or Alternative Presentation

Equipment and Supplies for Film

Equipment

1	16mm projector
1	overhead projector w/screen
1	tape recorder (used with alternative)

Supplies

1	film about construction technology
1	Transparency 5

Overview (5)

1. Remember that we are studying about construction technology.
2. Construction technology has three basic branches: they concern management, personnel, and production.
3. Today you will . . . see a film on construction *or* discuss construction technology.
4. I will tell you about the general sequence of steps or system common to the building of most construction projects.
5. (If the alternate discussion is used) We will talk about some things that need to be planned, organized, controlled, and processed.

Lecture (5)

1. You have read that man's constructed world is built by a managed production system. This system changes the form of materials on a site.
2. Many kinds of people work together to build and service our constructed world. They do this through a general sequence of steps. (Show Transparency 5, Common Sequence of Construction Practices.) These steps are as follows: (Let students name examples of each.)
   a. Beginning a project
   b. Selecting a site
   c. Designing a structure
   d. Engineering the structure
   e. Contracting
   f. Clearing the site
   g. Earthmoving
   h. Setting the foundation
   i. Building the superstructure
   j. Finishing the structure
   k. Completing the site
   l. Transferring the project
   m. Servicing property
3. You are going to watch a film on construction. See if you can identify these steps in the film. Watch for the different kinds of workers and what they do. After the film we will see if you can identify some of the activities as being examples of management, personnel, or production practices.

Film (30)

1. Today you will watch a film about "The World of Construction." Observe the management, personnel, and production practices.
2. Show the film.

Suggested Alternatives (if no film is available)

1. Expand on the lecture. Let students give examples of work done in Steps *a* through *m* (listed in the lecture) as you write the steps on the chalkboard. Use the text table of contents for the expansion of these concepts.

2. Get a guest speaker (someone in the construction industry). Tape his talk if he can meet with only one class section, and use it for your other classes.
3. Visit a nearby construction site.

Discussion (5)

The following questions may help the student clarify his thinking about construction technology.

1. Which branch of industry involves building structures on a site? (Construction.)
2. Can you define construction technology? (Knowing how to build something on a site.)
3. Why is construction a managed production system? (It deals with planning, organizing, and controlling all the men and materials used in construction.)
4. Can you name some management practices, production practices, and personnel practices? (Examples: *management*—planning, organizing, etc.; *personnel*—hiring, training, etc.; *production*—preprocessing, processing of goods.)
5. Can you name some things that are planned? (The site, structure, specifications, etc.)
6. Can you name some things that need to be organized? (People: contractors, masons, electricians, plumbers. Scheduling of work. Arrival of materials.)
7. Can you name some things that need to be controlled? (Quality of work, labor relations, scheduling, quality of materials, cost, etc.)
8. Can you name some ways in which a change is made in the form of material? (Mixing concrete, excavating earth, sawing boards, welding steel, laying block, etc.)

Homework

Reading 3

ASSIGNMENT 6, UNIT 3

Applying Technology to People

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given structures related to personnel technology:
   a. Compare a coffee break on a job with a recess at school and tell why people always work harder or better after a break.
   b. Suggest two or three ways to handle each of these personnel problems.
      1) A construction worker does not like to wear his safety helmet.
      2) A worker who is very friendly wastes time talking.
      3) A man who works very hard thinks he is not paid enough because other workers get the same wages and do less work.

Discussion

2. Given a series of questions, identify who hires contractors, architects, engineers, tradesmen, supervisors, and foremen and identify how they may be trained, assigned to jobs, advanced, and retired.

Laboratory Activity

3. Given the Laboratory Manual and instructions by the instructor, apply the management technology of organizing to people and things by:
   a. Structuring the class into groups, each consisting of a foreman, timekeeper, recorder, safety and grievance man, and equipment supervisor, for efficient classroom operation.
   b. Coding the Laboratory Manuals for easy organization, identification, distribution, and collection.

Time Schedule

5 Overview
5 Lecture
10 Discussion
25 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Supplies (Per teacher)

2	felt markers (one color for each class period)
1	Class Organization Chart

Overview (5)

1. You have read that personnel technology can be called "ways of causing people to do things."
2. The whole idea of personnel technology is a new one.
3. The technology that helps us process materials is very exact. The technology that helps us guide workers is not.
4. Personnel technology is intended to influence people to work safely and efficiently and to find jobs they like and do well.
5. Manufacturing workers now make up the largest employment group.
6. The three fastest growing employment groups are *government, services* (to people and things), and *construction.*
7. I am going to tell you about personnel technology.
8. We will discuss how people are hired, trained, placed on jobs, advanced, and retired.
9. We will then apply a little of the management technology of organizing to people and things to prepare for efficient classroom operation.

Lecture (5)

1. Personnel technology can be thought of as the ways in which people are *hired, trained, assigned to jobs, advanced,* and *retired* in the managed production system of construction. (Write these words on the chalkboard for emphasis and referral.)
2. All the craftsmen who work in construction trades have been trained. When they are hired, they agree to work according to certain conditions of employment. Advancement practices (raises in wages and promotions) are used to reward efficient personnel. Those who cannot meet job requirements may be demoted or let go. Eventually, satisfactory employees are retired. Contractors, engineers, architects, surveyors, equipment operators, plumbers, plasterers, painters, wallpaper hangers, and all construction personnel are affected by personnel practices.
3. Personnel practices have been developed to make work reasonably enjoyable, safe, and productive.

Discussion (10)

The following questions may be used to promote discussion.

1. Do any of you know a construction contractor? Do you know who might hire a contractor and how is he hired? What skills and knowledge does he need? How might a person get the training to do this work?
2. Do any of you know an architect or a civil engineer? (Ask further questions as in *1* above.)
3. Who knows a plumber, electrician, or plasterer? How is he hired? Where and how is he trained? What might he do to earn a promotion? A demotion?
4. Who knows a construction foreman or supervisor? How is he hired? How might a carpenter foreman's job be different from a carpenter's job?

Laboratory Activity (25)

The following suggestions will help you organize and structure the class for efficient operation.

1. Set up a color code, using a felt marker of a different color for each class period. Example: Period 1-red, Period 2-green, etc.
2. Have the students each get their Laboratory Manuals and return to their places. Time this activity. Report how long it took to get the Manuals distributed. Explain that it is not efficient to use so much class time this way. Tell them they are going to organize to be more efficient.
3. Select or divide the class into groups (four or five students per group), and assign each group a number.
4. Assign each group a workbench. Explain that in industry jobs also are assigned. However, in class each group will select persons for jobs.
5. Have each group select a foreman, equipment supervisor, timekeeper, recorder and grievance man. Have one student be both the timekeeper and recorder if you have groups of only four students.

6. Have the equipment supervisors pass around felt markers (in their class's color) so each student can record his group number on his Laboratory Manual. The number is to be printed on the binding so it shows when the manual is shelved.
7. Have each recorder print the names of the students in his group and their job titles on your Class Organization Chart.
8. Have each equipment supervisor collect and store his group's Laboratory Manuals in an appropriate storage area.
9. Now have the *equipment supervisors* pass out the Laboratory Manuals. Time the operation. Compare times for the organized and the unorganized work. Ask the class for reasons why personnel and things are organized. (Safety, saving time, saving effort.)
10. Have the equipment supervisors collect and store the Laboratory Manuals.

Homework

Reading 4

Class Organization Chart for Period (or Section) No.________ Color________

Group	Foreman	Timekeeper	Recorder	Safety and Grievance Man	Equipment Supervisor	Alternate
1						
2						
3						
4						
5						
6						

Class Organization Chart for Period (or Section) No.________ Color________

Group	Foreman	Timekeeper	Recorder	Safety and Grievance Man	Equipment Supervisor	Alternate
1						
2						
3						
4						
5						
6						

Class Organization Chart for Period (or Section) No.________ Color________

Group	Foreman	Timekeeper	Recorder	Safety and Grievance Man	Equipment Supervisor	Alternate
1						
2						
3						
4						
5						
6						

Class Organization Chart for Period (or Section) No.________ Color________

Group	Foreman	Timekeeper	Recorder	Safety and Grievance Man	Equipment Supervisor	Alternate
1						
2						
3						
4						
5						
6						

Class Organization Chart for Period (or Section) No.________ Color________

Group	Foreman	Timekeeper	Recorder	Safety and Grievance Man	Equipment Supervisor	Alternate
1						
2						
3						
4						
5						
6						

Class Organization Chart for Period (or Section) No.__________ Color__________

Group	Foreman	Timekeeper	Recorder	Safety and Grievance Man	Equipment Supervisor	Alternate
1						
2						
3						
4						
5						
6						

ASSIGNMENT 7, UNIT 4

Managing Construction

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given instructions related to managing technology:
   a. Describe what *planning, organizing,* and *controlling* tasks each of these committees would have for a class party.
      1) Food committee
      2) Decorating committee
      3) Entertainment committee
   b. Name some of your activities that fit into the categories of:
      1) *Retrieving* (What was?)
      2) *Describing* (What is?)
      3) *Experimenting* (What will be?)

Discussion

2. Given a list of management activities, classify and give examples of each one as belonging to the planning function, the organizing function, or the controlling function of management.

Laboratory Activity

3. Given the word game "Build," answer questions about the concepts used in the game.

Time Schedule

5 Overview
15 Discussion
25 Laboratory Activity

Equipment and Supplies for Discussion

Equipment

1 overhead projector w/screen

Supplies

Transparency 7

Overview (5)

Yesterday you learned that organizing personnel improves efficiency.

1. Today we will discuss the management functions in construction.
   a. There are three main functions of management in construction. They are called *planning, organizing,* and *controlling*.
   b. The planning function includes formulating, researching, designing, and engineering.

   c. The organizing function includes structuring and supplying.
   d. The controlling function includes directing, monitoring, reporting, and correcting.
2. During the laboratory activity we will play a game similar to bingo, called "Build;" but instead of using numbers, we will use concepts relating to management, personnel, processing, and structures.

Discussion (15)

Discussion will concern the major activities of POC (planning, organizing, and controlling) as applied to the construction of a swimming pool, a clubhouse, or a basketball court.

1. Show Transparency 7, Management Functions, with three main headings: Planning, Organizing, and Controlling. Give the students examples why each of these activities belong in one of the three categories: correcting, designing, directing, engineering, formulating, monitoring, reporting, researching, structuring, supplying. (The completed chart shown here also indicates the usual sequence of activities.)

Planning
  formulating
  researching
  designing
  engineering
Organizing
  structuring
  supplying
Controlling
  directing
  monitoring
  reporting
  correcting

2. Use one of the following situations as an aid in strengthening the students' comprehension of the various POC activities: the construction of a swimming pool, the construction of a clubhouse, or the construction of a basketball court. (Choose the structure that will be most familiar to your students.)
3. The following questions may be asked to encourage the students to demonstrate their understanding of POC.

   Planning Phase
   a. In formulating, what decisions must be made? (What is to be constructed and why. Can it be built?)
   b. What researching must be done for this construction activity? (Find out about conditions at the site, suitable materials, etc.)
   c. What designing must be done? (The size, shape, what it will look like, etc.)
   d. What engineering problems must be considered? (Costs, specifications, working drawings, etc.)

   Organizing Phase
   e. How does a construction contractor structure (organize) his company? (He decides what work is to be done, what type of workers will do it, and when and where they will do it.)
   f. How will he supply this construction system with tools, materials, and personnel? (Obtain workers from unions. Buy materials and supplies, etc.)

   Controlling Phase
   g. Who will direct each kind of construction activity? What will be his duties? (Foreman: he will direct men in their work with proper tools, equipment, and material.)
   h. Who will monitor this construction? What will be monitored? (Foremen, engineers, architects, etc. Check on the work, the materials, safety conditions at the site, etc.)
   i. Who will report about this activity? What will be his duties? (Inspectors, foremen, etc. report both about what is satisfactory and also about anything that is wrong.)
   j. Who will do the correcting work? What will be his duties? (Carpenter, engineers, architects, etc. make changes to correct what is wrong.)

Laboratory Activity (25)

Students may play a version of bingo, based on words used in the construction industry. The game is called "Build."

1. Have the students get out their Laboratory Manuals and turn to Activity 4.
2. The Laboratory Manual provides each student with two blank forms on which to play "Build." See Figs. 4-2 and 4-3.
3. Have each student pick *any five* words under *B* (Fig. 4-1) and record them in the *B* column of Fig. 4-2. He is to do the same for the columns *U*, *I*, *L*, and *D*.

B	U	I	L	D
highway	tower	monitoring	substructure	superstructure
tunnel	dam	researching	designing	structuring
directing	bridge	processing	management	grievance
structure	organizing	skyscraper	economy	manufacturing
planning	architect	employer	supplying	construction
correcting	formulating	controlling	initiator	personnel
engineer	reporting	tradesman	servicing	technology
industry	contractor	demolishing	directing	engineering

Laboratory Manual Fig. 4-1. Words

B	U	I	L	D
		FREE		

Laboratory Manual Fig. 4-2. Game Board

4. After the charts are complete, choose any word under B and announce it. For example, say "under B, tunnel." The word can only count as an entry after a student (selected at random) answers a question about the word. Make up questions about the word. For example: "Is a tunnel constructed or manufactured?" "Why is a tunnel built?" "What purpose does a tunnel serve?" As another example: "Is planning part of management or processing?" "Of what practice is 'correcting' a function?" If the answer is not suitable, go on to another word. Have the students check (√) the acceptable entry words on Fig. 4-2. Keep a record of the acceptable words.
5. Continue selecting words and asking questions under each column until a student shows five words in a row in any direction—horizontal, vertical, or diagonal. When a student has five acceptable words in a row, he is to call out "Build."
6. To increase enthusiasm, it is suggested that a school supply, such as a pencil or pen, be awarded each winner. You may also want to continue the game until a second place or third place winner is determined, or start a new game. If time allows, you may play the game a second time using Fig. 4-3 in the Laboratory Manual.

Homework

Review Readings 1-4.

Note: Preassemble five or six "Big Builder" games prior to Assignment 8.

Review 1–4

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a "Big Builder" game:
    a. Become familiar with the terms and sequence of the managed production system.
    b. Compete against opponent players in becoming the "Big Builder" or winner of the game.

Time Schedule

5 Overview
40 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Group of 4 to 6)

1	Big Builder game

Overview (5)

1. You have read during the past few days about man and technology, construction technology, management technology, and personnel technology.
2. To help you get a better idea of what these terms mean and to get an idea of the processes by which all things are constructed, today you will play a game called "Big Builder." You will be competing with others to see who will be the economic winner or "Big Builder."
3. First, we will all go through the instructions to understand how the game is played. The game has many of the important ideas that you will be studying in this course.

Laboratory Activity (40)

The following directions should help you conduct the gaming session.

1. Preassemble five or six game boards prior to class.
2. Distribute the games, rules, bid and balance sheets, playing pieces, etc.
3. Have the students follow along as you read the instructions.
4. Emphasize the importance of becoming familiar with the construction system (sequence of steps around the board).
5. Start the play. Demonstrate how to "Bid" and conduct "Transferring the Project" when these steps of the game come into play.
6. You may not get through a whole game session today. The game can be used as a review or to take up any slack time during the year, as when periods are less than a full period.
7. Store the games neatly as they are required in Assignment 44.

Homework

Reading 5

Suggest also to students that they search recent issues of your local newspaper for articles about problems in your community relating to shelter, health, education, recreation, and transportation. Ask them to clip and bring in articles on these topics. (See Assignment 9.)

ASSIGNMENT 9, UNIT 5

Beginning the Project

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to beginning a project:
   a. Give reasons for spending *public funds* to build a recreation center for teenage boys and girls.
   b. Name who might provide the money, and why the project is planned as a private project.
   c. Name some things you would have to know about to determine if a recreation center is *feasible.*

Discussion

2. Given the lecture and Reading 5:
   a. Define the terms "feasibility" and "feasibility study."
   b. Define the term "initiator."
3. Given local newspaper clippings, identify local community problems and recommended solutions.

Laboratory Activity

4. Given a list of community problems and possible solutions and acting as professional consultants, identify some basic problems that exist in their community and recommend a solution.
5. Given five major community problems and recommended solutions and acting as a city planning commission, select a project to be supported and develop the publicity for the project.

Time Schedule

5	Overview
10	Lecture
10	Discussion
20	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Supplies (Per class)

5 sht. 8½″ x 11″ paper

Overview (5)

Today's lesson concerns ways that a project can be initiated (started), and ways of following through to see if the project is feasible or worthwhile.

1. The text described ways of initiating public and private projects.
2. In the lecture you will learn more about how a project is started.
3. In the discussion we will talk about some of the terms used in this unit and examine some of our community problems.
4. Today you will take part in two laboratory activities. First you will act as public initiators to determine some of the major problems in our community and recommend solutions. Then you will act as a city planning commission to select a project and develop publicity for it.

Lecture (10)

1. There are many ways to start projects in a community. A project often gets started, or *initiated,* when a group such as this class gets together and decides to do something. The people in such a group can be called *initiators.*
2. Private citizens may initiate construction projects. If a man thinks that he may want to have a laundromat building constructed, or a private lake, he can become a *private initiator.* This kind of project will then be financed by a private source of money.
3. A group of private citizens also may initiate a public construction project. For example, the families in your neighborhood might decide that the city should build a new recreation center. They would take the idea to the public officials of your community—perhaps to the city council. The public officials would decide whether the recreation center was needed.
4. Individuals or groups who work for the government may also initiate construction projects. For example, the federal government and the states have departments that plan and direct the building of highways. Some of the highway projects are constructed after private citizens ask for them, but some of the projects are initiated by the highway departments of other government agencies.
5. After the need of a project has been established, someone has to determine if the

project is *feasible* or worthwhile; that is, can it be built and will it be worth building? This is called *making a feasibility study*.

6. Some projects cannot be constructed. For example, the landowner who wants a private lake may find that the rock layer beneath his soil will allow water to drain away. This means that even if he had a lake bed dug, it would be nearly dry most of the time.
7. Some projects are not worth building. For example, there might not be enough customers for a laundromat to pay back the owner for the building and machines and to bring him a profit.
8. More public projects would be built if there were no limits on the amount of money which could be spent. But since the government spends the money of its private citizens, it can spend only what the people can afford to pay.
9. If it is determined that a project is not feasible, it is usually dropped.

Discussion (10)

Discuss the following with the students:

1. Who is an initiator? (A person who has an idea about a project and who helps in getting the project started.)
2. Name some people you know, or have heard of, who are private initiators. (Examples might be businessmen, alone or acting as a corporation.)
3. Name some people or groups who are public initiators. (Examples might be from city, state, or federal government.)
4. What does "feasible" mean? (Practical or workable. It refers to whether something can be done successfully.)
5. What is a feasibility study? (A study to determine whether an idea is feasible or practical.)
6. Discuss the newspaper clippings that students have brought in concerning local community problems related to shelter, health, education, recreation, and transportation.

Laboratory Activity (20)

Today the class will act as groups of consultants for a city planning commission, to help identify some problems in our community.

1. Divide the class into their work groups.
2. Have each group select a community problem from Fig. 5-1 in the Laboratory Manual.
3. Those who brought in newspaper clippings (text problem) should distribute them to the appropriate group: shelter, health, education, recreation, or transportation.
4. Proceed with Problem 1. Have the recorder for each group write his group's chosen problem and solution on the chalkboard.
5. For Problem 2, the class will act as a city planning commission. The chairman (foreman) of each consultant group should present the reasons for his group's selection.
6. After the pros and cons of each problem are discussed by the class, have them vote on a project.
7. The class should now discuss how they will publicize the project and what the publicity should say. Record these ideas on the chalkboard.

Homework

Reading 6

ASSIGNMENT 10, UNIT 6

Selecting a Site

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to selecting a site:
   a. Name some general needs that people must keep in mind, in deciding where to build a:
      1) New airport
      2) Shopping center
      3) Factory
   b. Name several things that you and the *seller* must agree about before you would buy his auto repair.
   c. Describe how negotiations would be affected if you only want to buy the garage *site* and have no need for the garage building or equipment.

Discussion

2. Given Reading 6 and a lecture:
   a. Define "site."
   b. Name three of the important factors in selecting a site, and explain why or how they are important.

Laboratory Activity

3. Given an illustration of potential construction sites in a community, a selected project to build, and a table of site feasibility factors:
   a. Identify the available sites on the illustration.
   b. Determine the feasibility of each site as a potential construction site.
   c. Select a site for the project.

Time Schedule

5 Overview
10 Lecture
5 Discussion
25 Laboratory Activity

Overview (5)

1. Yesterday you learned that an initiator is someone who takes the needed steps to begin or initiate a project.
2. A private construction project may be built for the initiator; he then becomes the owner.
3. A public project is constructed for some agency of government, and the public is the owner.
4. A good site is one key to the success of any construction project.
5. The lecture today will focus on factors to consider in selecting a site.
6. I will also review two ways of obtaining a site.
7. The class will discuss how to select the best site for various uses.
8. As a laboratory activity, the class will determine the feasibility of several sites for the project we agreed on yesterday and select the best site for our purpose. (NOTE: If a class has selected a project for which the sites shown are not appropriate, you may want to suggest some other project for today's laboratory activity.)

Lecture (10)

What is a site and what should be considered in choosing one?

1. A site is a location or an area on which anything is, has been, or is to be constructed.
2. Selecting the best site available for the purpose results in the lowest overall cost and the highest amount of usefulness.
3. There are many factors to consider in selecting a site. (Write the following on the chalkboard.) Some of these factors apply to all projects; some do not:
   a. Cost
   b. Soil type
   c. Community environment
   d. Available utilities
   e. Suitability of climate
   f. Location
   g. Purpose for which the site will be used
   h. Available transportation
   i. Clearing-removal of existing obstacles
   j. Fill-earth needed to build up the site and provide for drainage
   k. Zoning—commercial, residential, or unzoned
4. A site, unlike a structure, can never be moved. Therefore, the planners should look ahead to see whether the location will be useful for a long time.
5. Much time should be taken to select the

site, for it is the main key to the success or failure of a project.

6. Sites are obtained either by negotiation or through a process called *condemnation;* that is, the land is declared to be for public use under the right of eminent domain (right of government to take over private property for public use by virtue of sovereign power over all lands within its jurisdiction).
7. *Negotiating* means talking or exchanging ideas to settle some kind of business. When a property sale is being negotiated, the person who owns it and the person who wants to buy it deal directly together until they agree on a price, a date when the buyer will take over the property, and other details.
8. When an agency of government needs to buy a piece of land for public use (for example, a new highway), the owner may not want to sell. Then the government can *condemn* the land, through court action, and take it from the owner. In *condemnation* proceedings, the court sets a fair price for the land.

Discussion (5)

1. What is a site? (A location or area on which anything is, has been, or is to be constructed.)
2. Can you name three of the factors to be considered in selecting a site? (Cost, labor supply, location, transportation, utilities, climate, soil, clearing, fill, zoning, and purpose for which it will be used.)
3. Why is location important? Cost? (Have students explain the importance of various factors. Develop examples to bring out ideas. See Questions 4 and 5.)
4. Should you select the least expensive site? (Not always, for the cheapest site might be the least desirable. It might be too far from transportation or utilities.)
5. Should you select a site with unknown soil qualities? (No. You should get advice from people who test soil and the rock underneath. It might be very expensive to build a foundation on the site.)

Laboratory Activity (25)

Today the class will choose the site in a community that would best suit the project they have chosen from Activity 5 (or an alternate project assigned by the teacher).

1. Have students seat themselves in a group as though they were at a business meeting.
2. Each student should have a pencil.
3. Proceed through the laboratory activity as a group of initiators might. Suggestion: call on individual students to orally fill in blank spaces of Fig. 6-2 (Site Feasibility Factors).
4. After the students have completed Fig. 6-2, have them compare and contrast the feasibility of the various sites. You should get general agreement on these factors: clearing needed, fill required, access, and location.
5. In addition, have the students compare and contrast these factors for each site: cost, soil, zoning, utilities, property tax, labor supply, and climate.
6. After they discuss these factors, have the class select (vote on) the most promising site.
7. It may not be possible to select a totally adequate site for your project. If this happens, explain that this happens many times in real life.

Homework

Reading 7

ASSIGNMENT 11, UNIT 7A

Buying Real Estate

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to buying real estate:
   a. Explain each of the following terms by using examples.
      1) *Boundaries*
      2) *Improvements*
      3) *Natural features*
      4) *Easements*
      5) *Encroachments*
   b. Name the kinds of information recorded on a deed for a building.

Discussion

2. Given the lecture:
   a. Explain why accurate measurement is essential in surveying.
   b. Explain why it is necessary to scale down dimensions.

Time Schedule

5	Overview
15	Lecture
5	Discussion
20	Demonstration

Equipment and Supplies for Lecture

Equipment

1	overhead projector/screen
1	grease pencil

Supplies

Transparencies 11-1, 11-2, 11-3

Equipment and Supplies for Demonstration

Equipment (Group of 5)

1	claw hammer
1	direction circle (from Laboratory Manual)
1	12′ steel tape
1 pr.	scissors
1	4′ straightedge (select a straight piece of wood)
1	framing square

Supplies (Group of 5)

1 pc.	½″ x 12″ x 12″ plywood
1 pc.	½″ x 48″ x 48″ plywood
5	4d finishing nails
1	ball string

Overview (5)

Thus far, you have learned how an initiator may begin a project, how a feasibility study is made to determine if the project can or should be built, and how a site is selected. You have read about buying real estate.

1. Today I will explain how to read scaled dimensions on a map.
2. We will discuss scaling dimensions, the need for accuracy in measurement, property description in deeds, and how a direction circle is used in surveying.
3. I will demonstrate how to use the direction circle and how to survey a piece of land according to a property description.

Lecture (15)

1. Show Transparency 11-1, Reading a Rule to Scale. Before you can read a map, you must know how to scale dimensions.
   a. Point out the divisions of a rule in *A* of 11-1: ⅛″, ¼″, ⅜″, ½″, ⅝″, ¾″, ⅞″, 1″, etc.
   b. If an object is drawn full size, the scale is full size. This means that 1″ of line equals 1″ of object.
   c. Explain *B* of 11-1, Reading a ½″ Scale: ½″ = 1′. Explain how to use this scale.
   d. In many cases it is not practical to draw a full-size drawing. The dimensions of the thing drawn might be too large to fit on drawing paper of the size you want to use. In this case, you would scale down the dimensions.
   e. Explain *C* of 11-1, Reading a ¼″ Scale: ¼″ = 1′. Explain how to use this scale.
   f. Explain *D* of 11-1, Reading a 1″ Scale: 1″ = 50′. Explain how to use this scale.
2. Show Transparency 11-2, Direction Circle. A circle is divided into 360 degrees.
   a. A surveyor uses a transit to measure the size of an angle in degrees. We will use a direction circle instead of a transit.
   b. From the center of a direction circle,

    lines go north, east, south, and west. They cut the circle into four *sectors*. The angle in each sector measures 90°. Together, the four angles add up to 360°. Each sector is in turn divided up with 5° segments.

  - c. To understand how a direction is named, think about two lines. One is a line that points in the direction you want to name. The other is the line that runs north and south. The two lines meet at an angle.
  - d. The north-south line cuts the direction circle at two points. The north point and the south point are both marked "zero." When you name a direction, you always start at the north or the south zero point and measure around toward the direction you want to name. You can measure toward the east or the west. For example, S 80° W means "start at the south zero and go west 80 degrees." (Locate this point on the transparency. Lay a rule from the center of the circle to this point and strike a line with a grease pencil.)
  - e. Demonstrate naming and finding angles from both zero points.

3. Show Transparency 11-3, Property Description. This is a property description taken from a deed.
   - a. A description similar to this is always found in the deed to a piece of land.
   - b. Leave the transparency on the projector. It will be used later.

Discussion (5)

1. Why must a surveyor measure very accurately? (To find the exact boundaries.)
2. In drawing, why do we sometimes scale down the dimensions? (The thing drawn may be too large to fit paper.)
3. How is a direction named? (With a north or south zero point, a movement to the west or to the east, and an angle.)
4. If a direction is named this way in a property description, how would you use a direction circle to survey the property? (The north-south line on the circle is lined up with true north and south. The name of the direction tells you which zero point to start from, which way to move, and how far to go around the circle.)
5. Will you always find a property description in a deed? (Yes.)

Demonstration (20)

Demonstrate surveying a plot of land.

1. Before class, lay out and cut the 12" x 12" piece of plywood according to the plan. See Fig. 11-1.
2. Locate carefully the "monument" position. Drive a brad into the plywood at this point, to represent a monument.
3. Draw lines through the monument as shown in Fig. 11-1. The vertical line will designate the north-south axis for the direction circle.
4. On the 48" x 48" plywood sheet locate the exact center. Draw two short intersecting lines through this point, parallel to the edges, to represent compass directions. Label them N, E, S, W. See Fig. 11-2.
5. Turn on the projector (Transparency 11-3) when you start measuring.
6. Place the 48" x 48" plywood on a bench

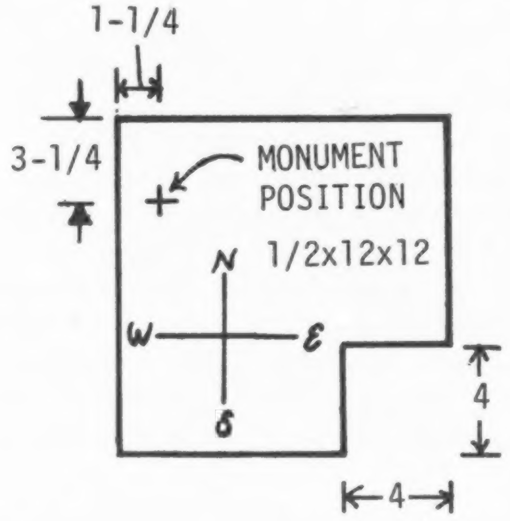


Fig. 11-1. Monument Marker Layout

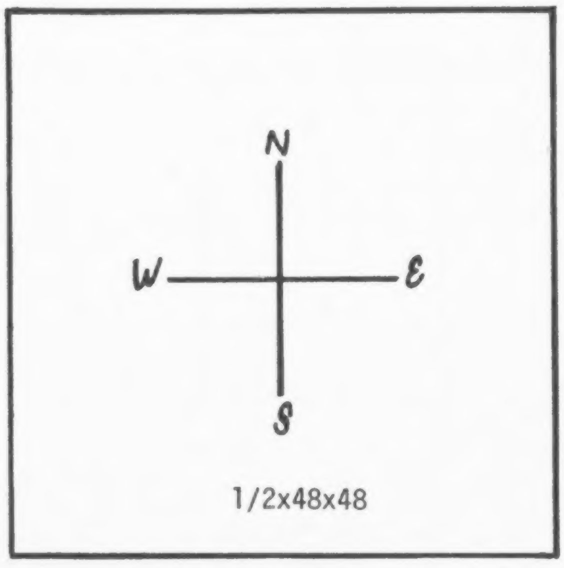


Fig. 11-2. Site Board

which has space around it for the students.

7. Gather the students around the bench.
8. Fit the northwest corner of the 48″ x 48″ piece into the notch in the 12″ x 12″ piece. See Fig. 11-3.
9. Place the center of the direction circle over the monument (brad). Position the circle so that the north-south axis of the direction circle matches the north-south axis on the plywood. (Emphasize this to students.)
10. Extend a line S 50° E over to the 48″ x 48″ piece of plywood. Using the scale ½″ = 1′, measure along the scale 20′ (10″). This is called point *A*. Drive a brad at this point. See Fig. 11-4.
11. With the help of students, follow the property description: "Thence due east along south property line owned by Mr. Jones, ninety-two feet." Scale down 92′ (46″).
12. Place the direction circle over point *A*, using a square to align it, and measure 46″ due east. This is point *B*. Drive a brad at this point. See Fig. 11-4.
13. The next direction is: "Thence S 20° W, eighty-three feet to an iron pipe on the north property line of property owned by Mr. Banks." Scale down 83′ (41½″).
14. Place the direction circle over point *B*, using a square to align it, and measure 41½″ in the direction S 20° W. This is point *C*. Drive a brad at this point. See Fig. 11-4.
15. The next direction is: "Thence S 80° W, sixty-seven feet to an iron pipe on the east line of Church Street." Scale down 67′ (33½″).
16. Place the direction circle over point *C*, using a square to align it, and measure 33½″ in the direction S 80° W. This is point *D*. Drive a brad at this point. See Fig. 11-4.
17. The last direction is: "Thence due north ninety feet to place of beginning." Scale down 90′ (45″).
18. Place the direction circle over point *D*, again using the square. If the directions were followed accurately, the distance from *D* to *A* should be about 45″. See Fig. 11-4.
19. With a string, connect points *A*, *B*, *C*, and *D*. See Fig. 11-4.
20. If time remains, students can start Activity 7A and B. Only one day is required to do Activity 7A and B.
21. Tape a piece of paper over the pin locations so the demonstration will be "new" for the next class.

Suggestions for Assignment 12, Unit 7A and B.

1. The lot to be surveyed can be painted green, and some model trees and bushes may be placed on the site for more realism.
2. The site could be layed out on the laboratory floor using chalk and tape instead of string and brads.

Homework

None

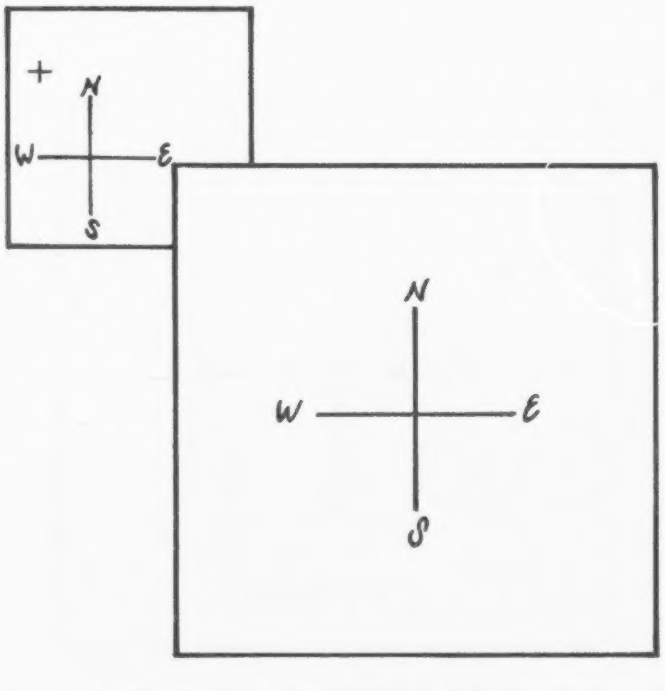


Fig. 11-3. Site Board and Monument Marker

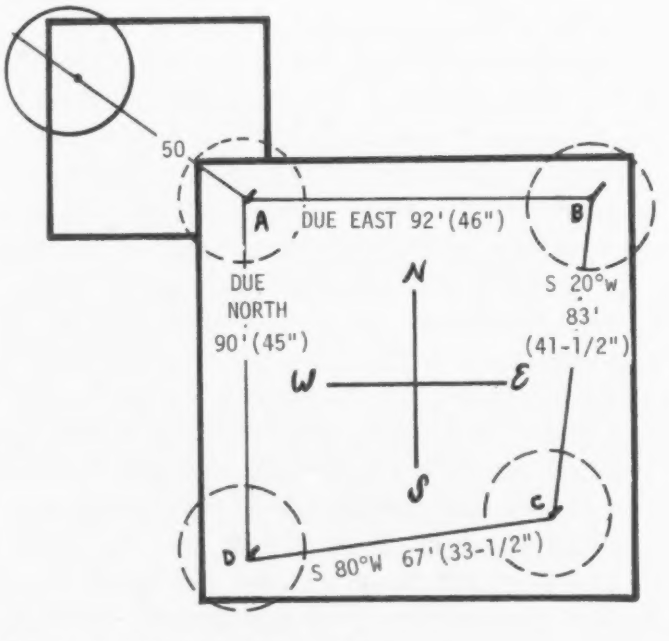


Fig. 11-4. Site Measurements

ASSIGNMENT 12, UNIT 7B

Buying Real Estate

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a legal description of a lot, use a mock surveying device to lay out a scaled-down model lot.

Time Schedule

5	Overview
5	Lecture-Discussion
35	Laboratory Activity

Equipment and Supplies for Lecture (Review)

Equipment

1	overhead projector/screen

Supplies

1 set	Transparencies 11-1, 11-2

Equipment and Supplies for Laboratory Activity

Equipment (per teacher)

5	claw hammers
5	steel tapes
5	4′ straightedges
5	direction circles (from Laboratory Manual)
1 pr.	scissors

Supplies (per teacher)

	4d finishing nails
5 pc.	½″ x 12″ x 12″ plywood, with monument marker*
5 pc.	½″ x 48″ x 48″ plywood
70 ft.	string or yarn (for boundary lines)

*The instructor should precut one piece for each group and attach the marker as shown in Fig. 12-1.

Overview (5)

1. Yesterday we discussed scaled dimensions. You were shown how to use the direction circle and how to lay out a lot.
2. Today I will review scaling and using the direction circle.
3. In your laboratory activity you will do some exercises with the direction circle. Then you will survey a model piece of land according to a property description.

Lecture-Discussion (5)

The teacher should reinforce yesterday's work and answer questions.

1. Review how to scale. (Use Transparency 11-1, Reading a Rule to Scale.)
2. Review reading the direction circle. (Use Transparency 11-2, Direction Circle.)

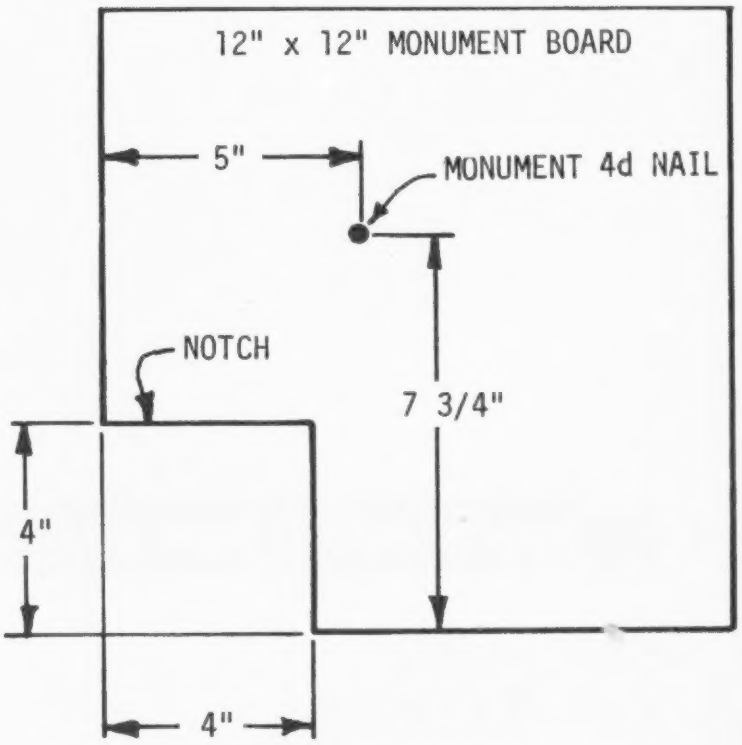


Fig. 12-1. Location of Monument Marker on Monument Site Board

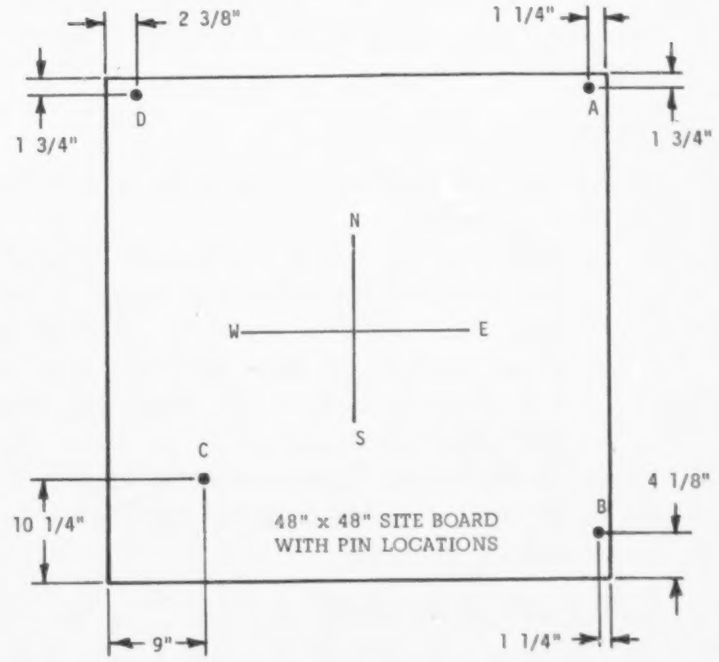


Fig. 12-2. Location of Site Marker Pins

Laboratory Activity (35)

You will now survey a lot similar to the one we surveyed yesterday.

1. Distribute equipment and supplies.
2. Have students work the Problem. Have all students follow the directions in Step 1 before any direction circles are removed from the Laboratory Manual. Have only one student per group remove his direction circle from a Laboratory Manual.
3. Check their ability to read the direction circle during the activity.
4. Assist students with any problems they may have.
5. When students finish, the brads (lot pins) should be located as shown in Fig. 12-2.
6. Have all students pull the pins and tape a sheet of paper over the location of the lot pins so the board will be "new" for the next class.

Homework

Reading 8

ASSIGNMENT 13, UNIT 8A

Surveying and Mapping

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to surveying and mapping:
   a. State why a *surveyor* begins his measuring from a *monument* or *bench mark.*
   b. List the *natural features* that may have existed, on and near the site of your school, before the land was settled and developed.
   c. Name what improvements would be shown on a *topographic map* of your school grounds.

Laboratory Activity

2. Given a site box with sand, a level bar, and a stadia rod:
   a. Measure elevation with a stadia rod.
   b. Record elevation data on a grid sheet.
   c. Draw contour lines by connecting all recorded elevations of the same height.

Time Schedule

5	Overview
15	Lecture
25	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	overhead projector/screen

Supplies

1 set	Transparencies 13-1, 13-2, 13-3
1	felt pen

The instructor also will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	site box with sand

1	level bar
1	stadia rod
1	level bar pin

Supplies (Group of 5)

1	grid chart (from Laboratory Manual)
1	pencil

Overview (5)

Yesterday you surveyed a model site to see if the boundaries or edges matched the legel description. You started at a permanent marker, or monument, measured distances at given angles, and marked corners with lot pins. You then compared the survey with the legal description and noted any errors.

1. Today I will show you how a topographic map of a site is developed.
2. You will see how to use a site box with a level bar and stadia rod and how to measure the contour of the land.
3. You will use a site box in your laboratory activity, measuring the contours of the sand in the box and recording the data on a grid map, and make a topographic map.

Demonstration (15)

The teacher's presentation today concerns the way a topographic map is developed.

1. Explain that after the boundaries of a site have been checked with the legal description and the site has been purchased, the topography is surveyed. The information obtained from surveying is used to make maps which the project designers will need.
2. Explain that in a topographic survey the natural and man-made features on the land are located exactly. Horizontal distances from the boundaries are measured and vertical heights and depths also are measured.
3. Using Transparency 13-1, Topographic Characteristics, explain what is shown:
   a. The shape of the land: that is, whether the land is flat or steep, which way the hills slope, etc.
   b. All natural features such as lakes, rivers, rock outcroppings, and trees and other vegetation.
   c. All major improvements: any buildings, roads, utility lines, and fences.
4. Show Transparency 13-2, Locating Elevations. Explain that the exact height of each important point on the building site is found by measuring its elevation with a level and rod. Elevation is the height above sea level.
5. Using the site box with sand piled in the center, show how to use the stadia rod and level bar. The holes in the level bar and site box represent 150′ intervals. The readings on the stadia rod represent 50′ intervals.
6. Explain that each elevation measurement is recorded on a grid chart. After all measurements are recorded, contour lines are drawn connecting every point which is at the same elevation. This can be explained by using Transparency 13-3, Contour Lines, to which an overlay of recorded elevation data has been added. This transparency is similar to the topographic map grid that the student will complete in the laboratory activity. Six contour lines have been drawn on the transparency. The instructor should draw a new elevation with a felt pen at 905′ to show the students how they should do it in their Laboratory Manuals. (See Fig. 13-4.)
7. Explain the characteristics of contour lines:
   a. Contour lines tend to parallel each other and to parallel streams or man-made features such as railroads.
   b. Contour lines never cross or touch except at overhanging or vertical cliffs and at waterfalls.
   c. Contour lines form smooth, natural curves.
   d. Contour lines always close on themselves either inside or outside the limits of the map sheet.
8. Using Transparency 13-2, show a sample of the contour lines on a map.

Laboratory Activity (25)

In today's activity students are to develop a topographic map using a grid system and contour-line technique.

1. See that each group has a site box with sand and level bar and stadia rod. See Figs. 13-1, 13-2, 13-3.
2. Check to see that each group has sloped the sand to the center of the site box. Emphasize *one hill only.*
3. Explain that before contour lines are drawn, all (117) measurements should be recorded.

Homework

None

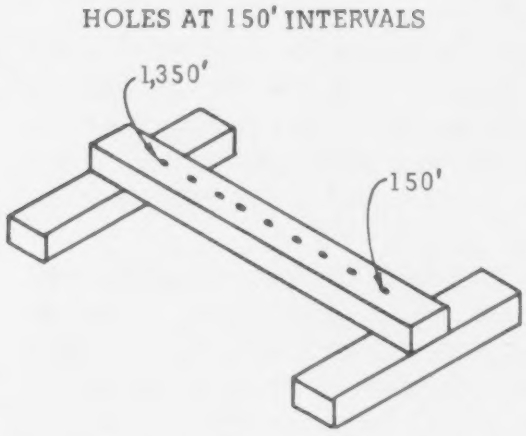
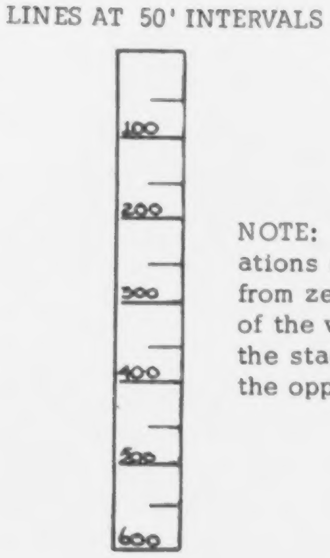

HOLES AT 150' INTERVALS
1,350'
150'

Fig. 13-1. Level Bar


LINES AT 50' INTERVALS
100
200
300
400
500
600

NOTE: In the field, the graduations on a level rod read upward from zero at the bottom. Because of the way this activity is designed, the stadia rod graduations read in the opposite direction.

Fig. 13-2. Stadia Rod

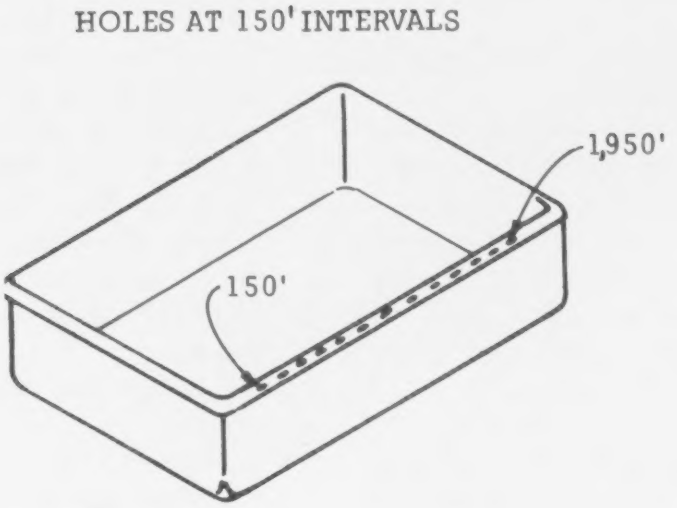
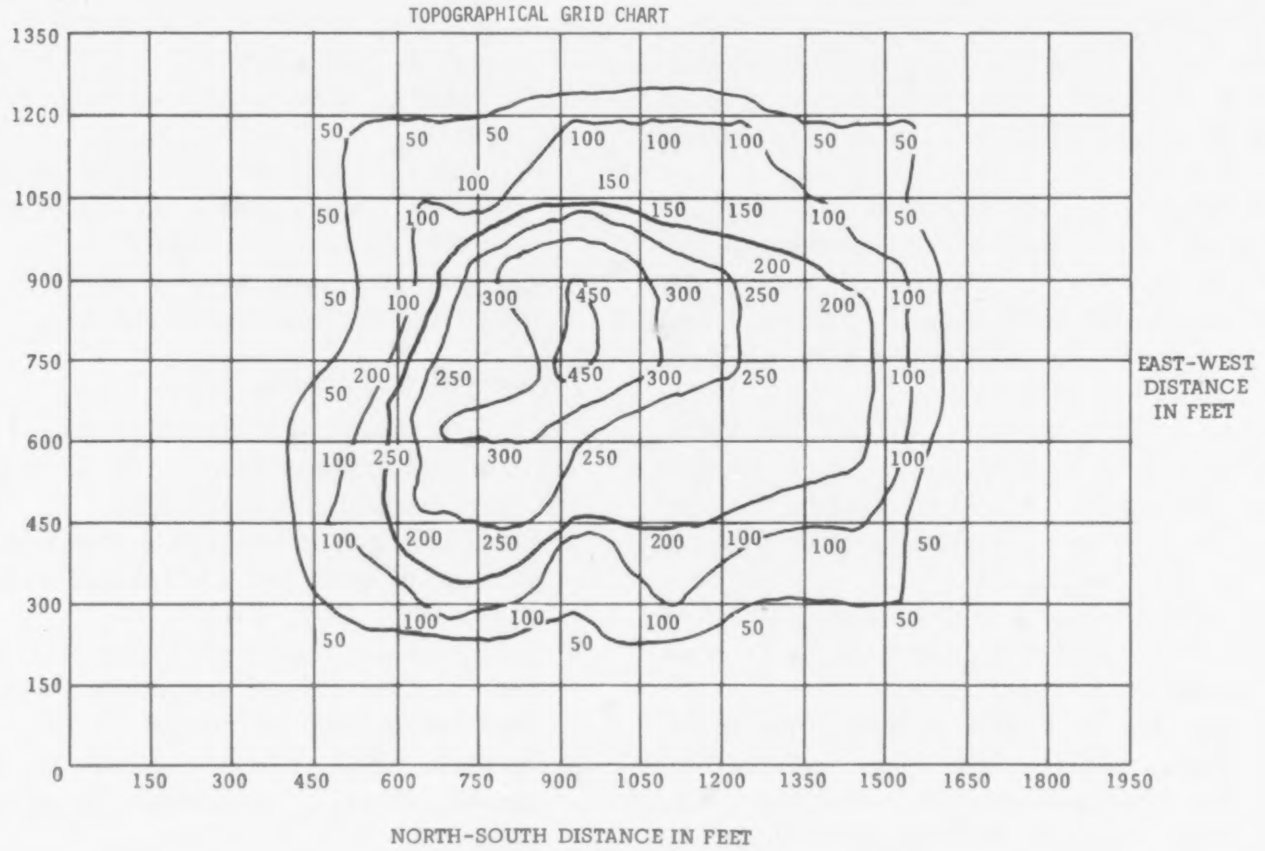

HOLES AT 150' INTERVALS
1,950'
150'

Fig. 13-3. Site Box


TOPOGRAPHICAL GRID CHART
1350
1200
1050
900
750
600
450
300
150
0
150
300
450
600
750
900
1050
1200
1350
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250
100
100
250
300
250
100
100
200
250
200
100
100
50
100
100
100
50
50
50
50
EAST-WEST DISTANCE IN FEET
NORTH-SOUTH DISTANCE IN FEET

Fig. 13-4. Topographical Map

Surveying and Mapping

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a topographic map showing a proposed highway route and two profile charts, plot the profile of the land surface along the length of the highway route and along a cross section.

Time Schedule

5 Overview
10 Demonstration
30 Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1 overhead projector/screen
1 12″ rule
1 grease pencil

Supplies

1 set Transparencies 14-1, 14-2

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1 12″ rule
1 pencil/eraser

Supplies (Class)

1 set colored pencils (optional)

Overview (5)

Yesterday you measured the elevation of a site using a level bar and stadia rod. You then recorded this information on a grid chart. You connected elevations of the same height with contour lines to form a topographic map.

1. Today I will show you how to make a profile map from a topographic map for a proposed highway site.
2. In your laboratory activity you will draw a profile view of a proposed highway site. You will then choose a better highway route and explain why it is a better route.

Demonstration (10)

Today the students will be shown how to make a profile map or view from a topographic map for a proposed highway site. The students will also choose their own site.

1. Explain to your students that you will demonstrate what they will be doing in their laboratory activity.
2. Using Transparency 14-1, What is a Profile, explain that a profile is the side view of an object. In this case, it is the side view of an imaginary cut through a piece of land. (You might also draw a profile of a student's head.)
3. Using Transparency 14-2, Topographic Map, Contours, and Profiles, explain how profiles are drawn.

   Length profile:

   a. Locate the part of the topographic map being profiled (line AA in the student's Laboratory Manual). Flip overlay 14-2, then remove.
   b. From this cutting line, lines are drawn straight down from the point at which the cutting plane line meets with the contour lines. These lines extend down to Profile Chart A. (Point out that these lines should be drawn lightly.)
   c. Mark the points at which the lines from the topographic map meet with the lines of the same elevation on the profile chart. (Use a grease pencil.)
   d. Any lines should be erased so that they will not interfere with the completed drawing.
   e. The profile is drawn by connecting the points on the profile chart. (Draw line with grease pencil.)
   f. The proposed highway will have an elevation of 910′. (Therefore, the students will draw a line on the profile charts in their Laboratory Manuals along the 910′ elevation line.)
   g. The part of the profile above and below the proposed highway elevation is shaded to show what land surface has to be removed or filled. The part below the line would have to be filled.

Cross section (width profile):

a. Locate the part of the topographic map being profiled (line BB in the student's Laboratory Manual). Flip overlay 14-2, then remove.

b. From this cutting line, lines are drawn straight down from the point at which the cutting line meets with the contour lines. These lines extend down to Profile Chart B. (Point out that these lines should be drawn lightly.)

c. Mark the points at which the lines from the topographic map meet with the lines of the same elevation on the profile chart. (Use grease pencil.)

d. Any lines should be erased so that they will not interfere with the completed drawing.

e. The profile is drawn by connecting the points on the profile chart. (Draw line.)

f. The proposed highway will have an elevation of 910′. Therefore, the students will draw a line on their profile charts along the 910′ level.

Laboratory Activity (30)

The students will plot the profile chart for the topographic map in their Laboratory Manuals.

1. Have students start Activity 8B.
2. Point out to students that the proposed highway site in Activity 8B may not be the best site. They may want to select a better site or draw the profile as you have just demonstrated.
3. Reasons for new site selection:
   a. Land is closer to the proposed road elevation.
   b. Therefore, less land fill or land cut will be necessary.
4. Each student should have a rule or straightedge.
5. Cut and fill can be shaded with colored pencils.

Homework

Reading 9

Answers for Laboratory Manual

1. Topographic
2. Elevation
3. Hill
4. 20′
5. 10′

ASSIGNMENT 15, UNIT 9A

Soil Testing

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to soil testing;
   a. Describe how the soil in your community may affect the following:
      1) Water supply
      2) Building foundations
      3) Basements
      4) Roadways
      5) Drainage
      6) Plant growth

Laboratory Activity

2. Given measuring devices, containers, and soil samples:
   a. Analyze two soil samples, clay and sand, to find out if excavation facing is needed.
   b. Test two soils, clay and sand, for water absorption.
   c. Analyze the soil strengths of clay and sand.

Time Schedule

5	Overview
10	Demonstration
30	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	piled foundation (a three-legged supporting device)
1	measuring cup
1	spoon
1	12″ rule

Supplies

1	brick
1 qt.	sand (damp)
1 qt.	clay (damp earth)
2	8 oz. paper cups
1	½ gal. milk container cut in half lengthwise
	paper towels

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	site box tray
2	plastic funnels
1	measuring cup
2	teaspoons
1 pr.	scissors

Supplies (Group of 5)

2	8 oz. paper cups
2	3″ x 14″ corrugated metal strips *or* milk carton strips for facings
1 qt.	sand (damp)
1 qt.	clay (damp)
1	½ gal. milk container*
4	1″ x 1″ x 4″ wooden blocks

*Cut in half lengthwise prior to class.

Overview (5)

Yesterday you drew a profile of a proposed highway site. Today you will learn about soil testing.

1. Your text explained about the composition of the earth's crust, some characteristics of soils, how soils are analyzed, how soil is used in construction, and how the composition of soils can be changed.
2. I will show you how moisture affects soil. The characteristics of soil depend a great deal on the amount of water in it.
3. In your laboratory activity, you will test two types of soil samples for their excavation characteristics, water absorption capacity, and soil strength.

Demonstration (10)

Today's demonstration concerns the effects of moisture on soil.

1. The equipment and supplies should be arranged beforehand.
   a. The clay and sand samples should be damp and free of debris.
   b. Cut a milk carton lengthwise to form two shallow pans, and cut holes in each pan bottom for drainage.
   c. Measure ½ cup of water into each paper cup.
2. Group students around the demonstration bench so all can see.
3. Explain that you are going to demonstrate the effect of moisture on the capacity of soil to support a load.
4. Fill one milk-carton pan ¾ full of sand and the other one ¾ full of clay. Do not compact the soil.
5. Draw Table 15-1 on the chalkboard. Record on it all the measurements made during the demonstration.

Loose Soil

6. Explain that each sample now represents loose soil. Set the piled foundation on top of the soil. Place one brick, representing the weight of a structure, on top of the piled foundation.
7. The legs of the piled foundation will sink or settle in the soil. Mark the point where each leg meets the soil surface. Measure with a rule the amount of settling and record it in the table.
8. Repeat Steps 6 and 7 for the other soil sample.

Compact Soil

9. Compact soil in both samples by packing it down with your thumb and the spoon. Explain that the compact soil represents firm, undisturbed soil. Repeat Steps 6 and 7.

Wet Soil

10. Add ½ cup of water to each soil sample. Explain that the water represents moisture conditions that are sometimes found at construction sites. Have students observe the water absorption rate of the soil samples.
11. Repeat Steps 6 and 7 for the wet soil samples.

Table 15-1

Soil Condition	Amount of Settling of Foundation In Sand	In Clay Earth	Which was greater?
Loose			
Compact			
Wet			

12. Have students compare the settling in sand and in clay for each soil condition. Complete the last column of the table.

Laboratory Activity (30)

The students will be testing two soil samples, clay and sand, for their excavation characteristics, water absorption capacity, and soil strength.

1. The instructor should have the sand and clay prepared for testing. They should be clear of debris.
2. Have the students work in their groups and have them open their Laboratory Manuals to Activity 9A. Before the students begin the activity, review the entire procedure with them.
3. The purpose of the activity is to determine the reaction of two kinds of soil to different conditions.
4. The instructor should circulate around the room, giving help as required.
5. At the end of the laboratory activity, place the soil pans in direct sunlight, if possible, or where air will circulate around them. An electric fan and sunlight will permit the soil to dry rapidly. Samples should dry within 24 hours to be used in Optional Activity 9B.
6. Activity 9B is optional. If you plan to omit it, there is no need to keep the soil samples.

Homework

None. Have students bring in their textbooks for review of Units 1-9 if optional Activity 9B is not used.

ASSIGNMENT 16, UNIT 9B (OPTIONAL)

Soil Testing

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given the lecture on soil compressibility and its relation to soil testing:
   a. State how to compute the percentage of soil compressibility.
   b. Name two factors related to soil compressibility.

Laboratory Activity

2. Given the soil samples of clay and sand:
   a. Test and compare the strength of two soil samples after water has evaporated.
   b. Test and compare the compressibility of two soil samples using two tamping techniques.

Time Schedule

5	Overview
10	Lecture-Demonstration
5	Discussion
25	Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1	overhead projector/screen

Supplies

1	sponge
1	bucket with water
1	Transparency 16

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	12″ rule

Supplies (Group of 5)

2	cartons containing soil samples from Activity 9A
2	1 lb. coffee cans
1	1″ x 1″ x 4″ wooden tamping block
	paper towels

Overview (5)

Yesterday you learned how to test two kinds of soil, clay and sand. Tests like this are made to see if the soil can support a structure before building begins.

1. Today I will show you how to measure soil compressibility.
2. We will discuss a technique for finding the amount of soil-volume compressibility and why builders need to know about compressibility.
3. In the laboratory activity, you will experiment and determine the compactness of the two soil samples, sand and clay, using two tamping procedures.

Lecture-Demonstration (10)

Today's presentation continues the unit on soil testing. It concerns soil compressibility and how to determine it.

1. Many kinds of material can be compressed. (Demonstrate by squeezing a dampened sponge.) When material is pressed together or compressed the way I squeezed this sponge, it decreases in volume. Volume is the space occupied.
2. When you let go of a damp sponge, it swells up again to its original volume. When soil is compressed into a smaller volume, it usually stays compressed. Compressing makes it more dense or compact.
3. When soil is dug up or excavated, it increases in volume.
4. Some kinds of soil expand or swell up more than others when they are dug up and can be compacted more when they are pressed down.
5. When loose soil is compacted, the change in volume is called *compressibility.* It can be measured, and it is usually given as a percentage.
6. To measure compressibility, you need to know how much space a soil sample takes up when it is loose, and how much it shrinks or loses when it is compacted. If the sample is in a container with straight sides, the original height of the sample and the loss in height are measured. (Show Transparency 16, Soil Testing.)
7. The size of the loose soil sample is considered "all" or 100%. The loss or shrinkage is a fraction of this amount. An arithmetic formula for finding the percent of shrinkage looks like this: (Show on the chalkboard.)

$$\frac{\text{Loss in height}}{\text{Original height}} = \frac{\%\ \text{loss}}{100\%}$$

8. In the example, the original height was 20″. When the soil was compacted, it lost 5″ of height. The loss was $\frac{5}{20}$ or $5 \div 20$.
9. When we do the division, the decimal answer is 0.25 and the same answer, changed to percent, is 25%. *This means the shrinkage or compressibility was 25%.*
10. From the laboratory activity, we will see that the amount soil compresses depends on the kind of soil and the way it is tamped.

Discussion (5)

The instructor should review the technique for finding the percentage of soil-volume compressibility and its relation to soil testing.

1. Are there any questions about the problem I just worked? (Review as needed.)
2. Here is another set of measurements. (Show on the chalkboard.)
   Height of loose soil: 10″
   Loss when compacted: 3″
3. How do we find the percentage of shrinkage? (Divide 3″ by 10″ to get 0.3, and change the answer to 30%.)
4. What does the figure 30% tell us about this soil sample? (The compressibility, or how much volume it will lose when it is compacted.)
5. Soil compressibility tests are used along with the other soil tests you conducted yesterday.
6. What factors affect the strength of the soil and its compressibility? (Size of the grains, the amount of water in the soil, and how it is tamped.)
7. Why must these factors be known? (To determine whether or not a piece of land will support a structure.)
8. Why is soil testing important? (Architects use the data in designing the foundation of the structure. Contractors use the data to plan for excavating and earth fills.)

Laboratory Activity (25)

In today's laboratory activity, students will try to determine the compressibility of two soil samples, clay and sand.

1. Show how to compact loose soil in a container by tamping it with a wooden block.
2. Have students turn to Activity 9B in their Laboratory Manual, and go over the directions with them.
3. Students are to meet in their regular groups that worked together in Activity 9A.
4. The instructor should check students' progress and give assistance as needed.
5. At the end of the activity, students should return soil samples and dispose of cartons.

Homework

None. Instruct students to bring in textbooks for Review 1-9.

ASSIGNMENT 17, UNIT 1-9 (OPTIONAL)

Review 1–9

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given the summaries of Readings 1-9, ask and answer questions about man and technology, construction technology, personnel technology, managing construction, beginning the project, selecting the site, buying real estate, surveying and mapping, and soil testing.

Time Schedule

45 Discussion or Laboratory Activity

Discussion or Laboratory Activity (45)

This review time can be used in various ways. Plan to do one of the following alternatives:

Alternatives

1. Students can play the "Big Builder" game to become more familiar with the concepts and processes of construction.
2. Pose the questions and situations at the end of each reading to stimulate thinking and discussion.
3. Have each group of students get together and list two or three words or concepts they would like to have explained or discussed. Discuss and clarify the concepts.
4. Ask a guest speaker, knowledgable about the design and engineering process to talk to the class. Schedule the speaker for the first class period and tape record his talk so it can be played to your other classes.
5. Schedule a field trip to an establishment where designing and engineering are done.

Homework

None

ASSIGNMENT 18

Test No. 1

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given IACP Construction Test No. 1, select the correct responses from a list of items related to concepts presented in Readings 1 to 9.

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

1. Seat the students to best advantage for administering a test.
2. Distribute pencils, erasers, and eraser shields.
3. Distribute answer sheets and fill out needed information.
4. Pass out test booklets. "Keep closed until I say to begin."
5. Read directions for filling in answers. Open test booklets and begin.
6. Allow 35 minutes for completion, then collect answer sheets, then test booklets.
7. Review the test with students to provide feedback.
8. For ease of grading, take an answer sheet and punch out holes over correct answers. This punched sheet can be used as an answer key. Lay it over the student's answer sheet. Where an answer does not appear through the hole, the teacher can mark it, indicating what the correct answer should be.

Homework

Reading 10

Answers for Test No. 1

1. B	2. A	3. D	4. C	5. C	6. B	7. D	8. D	9. C
10. B	11. C	12. A	13. D	14. D	15. A	16. D	17. A	18. D
19. A	20. B	21. C	22. B	23. A	24. B	25. C	26. A	27. D
28. A	29. A	30. C	31. D	32. B	33. A	34. C	35. D	

ASSIGNMENT 19, UNIT 10

Designing and Engineering Construction Projects

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given the design procedures for a neighborhood playground:
    a. Describe what needs to be done to:
        1) Identify the problem
        2) Develop preliminary ideas
        3) Define these ideas
        4) Analyze the design
        5) Select the final design
        6) Get the playground built (implement the design)

Discussion

2. Given a series of pictures of construction projects, identify the function of each project and the need for each one.
3. Given a series of pictures of construction projects, suggest at least two problems relating to the design of each project.

Laboratory Activity

4. Given six design steps, together with illustrations and descriptions of several construction projects, match the design step with the illustration.
5. Given illustrations and descriptions of construction projects, indicate for each project whether the chief designer probably was an architect, an engineer, or an architect *and* an engineer.

Time Schedule

5	Overview
15	Lecture
15	Discussion
10	Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1 filmstrip projector/screen

Supplies

1 Filmstrip 19, Designing and Engineering Construction Projects
(Frames 1-15 for lecture;
Frames 16-23 for discussion)

Overview (5)

Today's lesson introduced the concepts of designing and engineering construction projects.

1. The reading explained (a) the need for designing before constructing a project, (b) what must be considered when designing construction projects and (c) the steps of procedure in the design process.
2. I will identify and explain the activities of the architect and the engineer and explain the design process further.
3. In the discussion, you will look at pictures of some construction projects, decide who may have been the primary designer of each one, and determine the function of the structure (the needs that it will meet).
4. In the laboratory activity, you will classify situations according to the design step shown and indicate whether each structure probably was designed by an architect, an engineer, or both.

Lecture (15)

Every construction project must be designed before construction can begin. The design process involves many people and is accomplished in several steps. Special attention is given to problems which might affect the construction of the project.

1. The design process involves many people, such as architects, engineers, contractors, and craftsmen. However, the design of most construction projects is directed mainly by either an architect or an engineer.
2. The architect is usually the primary designer of buildings: for example, homes, shopping centers, apartment buildings, and community centers.
3. The engineer is usually the primary designer of such construction projects as bridges, dams, stadiums, and highways.
4. In designing some construction projects, an engineer and an architect work together. Each contributes his special knowledge.

5. Every construction project has similar problems which must be considered by the designer whether he is an architect or an engineer. These primary considerations are: function, appearance, cost, materials, and strength.
   a. Function refers to whether the project will meet the needs for which it is constructed.
   b. Appearance refers to whether the structure will look attractive or pleasing and whether it will fit in with its surroundings.
   c. Cost is a major problem; it may be the hardest one to solve.
   d. Materials and strength are usually considered as they relate to the structure of the project.
6. Now we are going to look at the steps in designing a restaurant. (Using Filmstrip 19, Frames 1 to 15, explain the design process.)

Script for Filmstrip 19 Lecture

Frame 1: (Focus and filmstrip identification number)

Frame 2: The World of Construction

Frame 3: Industrial Arts Curriculum Project The Ohio State University

Frame 4: Designing and Engineering Construction Projects

Frame 5: The Design Process
Step 1. Problem Identification
Step 2. Preliminary Ideas
Step 3. Refinement
Step 4. Analysis
Step 5. Decision
Step 6. Implementation
There are six basic steps in the design process. You are going to see how an architect-designer applies the basic steps to a specific problem.

Frame 6: Step 1. **Problem Identification**
Identify the Problem.
A problem is being identified in detail. A man wants to build a restaurant. The architect-designer will find out how large a kitchen is needed, how many chairs and tables are required, and many other details.

Frame 7: Step 2. **Preliminary Ideas**
Sketch or Write Down Preliminary Ideas.
The architect begins to make sketches and notes about his first—or preliminary—ideas.

Frame 8: (Illustrations of Three Preliminary Sketches)
The architect sketches three ideas. Each one shows a different floor plan.

Frame 9: Step 3. **Refinement**
Refine Preliminary Ideas.
The architect refines his ideas; that is, he works them out in more details.

Frame 10: (Illustration of a refined sketch)
Here one of the ideas has been refined. All the rough sketches may be refined, or some may be dropped at this stage.

Frame 11: (A scale drawing)
This is a further refinement. The plan is now drawn to scale.

Frame 12: Step 4. **Analysis**
Analyze Each Part of Each Design.
The architect and his client will analyze each of the designs in many ways. Can waiters enter and leave the kitchen easily? Is the dining area large enough? Is there space for temporary storage near the service entrance?

Frame 13: Step 5. **Decision**
Decide on One Design.
The client or initiator decides. This is the plan he wants.

Frame 14: Step 6. **Implementation**
Construct the Structure.
To implement the decision, the architect begins preparing a full set of drawings for the restaurant. A contractor is hired and construction begins.

Frame 15: (Picture of a Restaurant)
The construction project is completed. A designer's idea has been translated into a restaurant.

Discussion (15)

Utilize Filmstrip 19, Frames 16 to 24, as the basis for a discussion of architects and engineers as designers and of problems in designing projects such as those shown.

1. Ask the following questions about each frame:
    a. What is the function of this construction project?
    b. Why do you think it was built?
    c. What did the engineer or architect need to know before he could design this construction project? (The number of people who would use the structure. The function or functions planned. How much money could be spent. The client's wishes concerning appearance or style. Etc.)
    d. What were probably some of the biggest problems solved by the designers?
2. These are the construction projects illustrated and the probable chief designer for each:

Frame 16: Large custom house (Architect)
Frame 17: Apartment building (Architect and engineer)
Frame 18: Large office building (Architect)
Frame 19: Shopping center (Architect)
Frame 20: Tunnel (Engineer)
Frame 21: Highway cloverleaf intersection (Engineer)
Frame 22: Bridge (Engineer)
Frame 23: Sports stadium (Engineer and architect)
Frame 24: Dam (Engineer)

Laboratory Activity (10)

Five construction projects are illustrated and/or described in the Laboratory Manual. Students are to determine which step in the design process is represented for each project, and whether it probably would be designed by an architect, an engineer, or both working together.

1. Be sure students understand the instructions in the Laboratory Manual before they fill out the chart.
2. The last question concerns only the chief designer for each project. Have students answer.
3. Discuss the answers when all students have completed the activity.

Homework

Reading 11

Answers for Laboratory Manual

Fig. 10-2. 1, architect
Fig. 10-3. 6, both
Fig. 10-4. 3, engineer
Fig. 10-5. 4, engineer
Fig. 10-6. 1, both
Note: 5, deciding on one design is not shown.

ASSIGNMENT 20, UNIT 11

Identifying the Design Problem

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to identifying design problems.
    a. Describe the general needs that these structures fill.
        1) Warehouse
        2) Garage
        3) School
        4) Hospital
        5) Factory
        6) Department store
    b. Describe what kinds of data should be gathered to plan how to move people from floor to floor in a new three-story hospital.
    c. *Evaluate* your answers to the above and tell how they will affect the building design.

Discussion

2. Given the problem of designing boating facilities at a community boating area, identify the major element of the problem.
3. Given the problem and the major elements of the problem, identify several kinds of data required to complete the problem identification.
4. Given the problem and several kinds of data, evaluate the effect of the data on the design problem.

Laboratory Activity

5. Given the problem of designing a community park, identify the major needs that the park should meet.
6. Given the major needs for a park, list several kinds of data that will help identify the needs.
7. Given the needs and related data, evaluate the data and determine the effect on the design problem.

Time Schedule

5	Overview
5	Lecture
10	Discussion
25	Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1	overhead projector/screen

Supplies

1	Transparencies 20-1, 20-2, 20-3
1	grease pencil

Overview (5)

Today's material concerns step one of the design process, identifying the design problem.

1. The reading introduced you to the basic steps in identifying a design problem.
2. Today I will review briefly the three steps in problem identification: identifying the needs, gathering data, and evaluating data.
3. We will discuss how the three steps in problem identification apply to the design of boating facilities at a community boating area.
4. In the laboratory activity you will apply the three steps in problem identification to the designing of a community park.

Lecture (5)

1. Show Transparency 20-1, Identifying the Design Problem. It is very important to identify the exact nature of a design problem before you start to look for possible solutions.
2. The first step in identifying the design problem is to identify the needs. You should ask yourself, "Why is this construction needed?" "Exactly how is it going to be used?"
3. The second step is to gather data. You should look for additional information that will help you describe the needs in more detail. Ask yourself, "What type of information am I looking for?" "Where will I find this information?"
4. The third step is to evaluate the data to discover how they will affect the design.

Discussion (10)

As an example, the three steps of problem identification will be applied, one by

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one, to a design problem at a community boating area.

1. This is the problem we start with: At a community boating site, an area is to be developed with facilities to accommodate boating activities.
2. In order to define the needs, ask yourself, "What are some things that must be considered in developing a boating area?" (Allow the students to discuss this question and suggest some of the many considerations, but do not spend too much time on this point. You should keep track of the ideas by writing them down on Transparency 20-2, Boating Area Needs, under "Needs.")
3. If your students do not have many ideas about this problem, you may need to stimulate their thinking. A list of more detailed questions is given here.
   a. How big will the boats be?
   b. How close to the shore can the boats get?
   c. How will the boats be kept near the shore?
   d. What kind of boats will be allowed in the area?
   e. How will the boats be stored during the time they are not in use?
   f. How will the boats be stored overnight?
   g. How many boats will be kept in the area?
   h. How will the people get from the shore to the boats?
   i. Should the boat storage area be covered?
   j. How will the boats be put into and taken out of the water?
   k. How will the boats be moved to the water's edge and away from the water's edge?

   You may wish to discuss only a few of the above considerations. The first three of these possible needs are developed on Transparency 20-2.
4. In order to begin collecting data, ask yourself, "What types of information will answer the questions about need?" and "Where can I get the necessary information?" (Allow the students to answer and keep track of the information on Transparency 20-2, under "Information" and "Sources.")
5. In order to evaluate the data, ask yourself, "Should some of the data be put into graphic form (charts or other diagrams)?" and "How do the data affect the design problem?" (Allow the students to answer the questions and keep track of the information on Transparency 20-2 under "Evaluating Data.")

Laboratory Activity (25)

The students will apply the three-step technique of identifying a design problem to the designing of a community park.

1. Tell the students to read the directions in their Laboratory Manual as you explain the activity.
2. The students will spend 10 minutes working individually to define the goals, to identify the data required, and to determine how the data influence the design.
3. Tell the students that each of them is to go through the same process the class just used. They are to keep in mind the following questions:
   a. What are some of the needs of the park?
   b. What information is required?
   c. Where can the data be obtained?
4. The students should form into groups and compare ideas on this problem for another 10 minutes.
5. At this time the instructor should use Transparency 20-3, Community Park Needs, to illustrate a possible solution for the activity.

Homework

Reading 12

ASSIGNMENT 21, UNIT 12A

Developing Preliminary Ideas

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to developing preliminary ideas:
   a. Give reasons why a designer should sketch and write his *preliminary ideas* before he works out exact dimensions.
   b. Describe your "brainstorming" ideas about one of the following structures.
      1) A house that can be cleaned inside and out using hot water from a garden hose.
      2) A combination garage and storage area that can be kept free of animals, insects, and excess dampness.

Discussion

2. Given the term "preliminary idea," identify its use in solving a design problem.
3. Given the term "preliminary ideas," identify the techniques used to record preliminary ideas for solving a design problem.

Laboratory Activity

4. Given the problem of designing a community park, develop preliminary ideas for park areas and structures.

Time Schedule

5	Overview
15	Lecture-Demonstration
5	Discussion
20	Laboratory Activity

Equipment and Supplies for Lecture-Demonstration

Equipment

1	overhead projector/screen

Supplies

1	Transparencies 21-1, 21-2. See Fig. 21-1

Equipment and Supplies for Laboratory Activity

Supplies (Per group)

1	file folder (to store sketches for Activities 12A through 18)

Supplies (Each student)

2	paper clips
3 pcs.	8½" x 11" tracing paper*

*Have additional tracing paper available at your desk.

Overview (5)

Today's lesson concerns step two of the design process: the concept of developing preliminary ideas.

1. The reading introduced you to the use of preliminary ideas for solving a design problem.
2. I will present a design problem and demonstrate how to record preliminary ideas.
3. You will be asked to explain what preliminary ideas are and how they are recorded.
4. In today's activity you will develop preliminary ideas for the recreation areas and structures in a community park.

Lecture-Demonstration (15)

(Note: You may want to prepare some ideas for use with Transparency 21-2 in Step 7 of this lecture-demonstration.)

In developing preliminary ideas for solving a design problem, there are several things to keep in mind.

1. A preliminary idea is an idea in an early stage. It is rough or unpolished.
2. It is important to put down on paper *all* your ideas for solving a design problem. Some of them may seem wild and unreasonable, but they may lead to other ideas that prove useful.
3. Preliminary ideas are recorded in very rough form. Crude circles and other shapes are usually sketched to represent areas or objects. Brief notes may be written on a rough sketch to complete the record of an idea. Notes may also be written on separate work sheets.
4. In general, the preliminary ideas will be related to the specific needs that were identified in step one of the design process.
5. a. Show Transparency 21-1, Designing a Community Park, and read the problem.

    Problem: Designing a Community Park.
  b. Explain that this problem has been analyzed, and several specific needs have been identified.
    1) There must be a food service structure.
    2) There must be a parking area.
    3) There must be a boat dock area.
    4) There must be at least one picnic area.
6. Show Transparency 21-2, Site Plan for Community Park. Discuss briefly the community park site. Point out the direction of the wind and the direction of the afternoon sun.
7. Using the blank overlay on Transparency 21-2 and a marking pencil, sketch in one idea relating to the problem. It should be a wild idea, such as a floating platform in the pond for picnics. In addition to sketching the circle to represent the area, you should make some notes about your idea, such as "floating platform," "bridge to get to platform," "railing around outside edge for safety," "the seating will be benches," etc.
8. Ideas may relate to area location, material, structures, facilities, furniture, and the location of structures and furniture within the area, etc.
9. Point out the fact that you have used an overlay to sketch and write on, in the same way that they will use a piece of tracing paper over the site drawing given in their Laboratory Manual.

Discussion (5)

1. What are preliminary ideas? (They are ideas in an early stage, rough or unpolished.)
2. In solving a design problem, which preliminary ideas are recorded? (All of them, including the ones that seem "far-out" or wild.)
3. How are preliminary ideas recorded? (Sketches, notes, and work sheets.)
4. What is the first step of the design process which leads to developing preliminary ideas? (Identifying needs.)

Laboratory Activity (20)

The students are to sketch preliminary ideas for recreation areas and structures as a step in developing a design for a community park. Figure 21-1 shows the site plan with which they will be working for several days. A 4′ x 4′ site box could be modeled to represent the community park to help students vizualize the area. See Assignment 56, Fig. 56-1 for box construction. The park area should be about 7 units wide by 9 units long.

1. Distribute the tracing paper and explain how it is to be used.
2. Students are to work individually.
3. Answer any questions that the student may have. Students can relocate any area except the pond, river, and highway.
4. Walk around the room and give help when needed.
5. During the last 10 minutes of the period, have the students tell about some of their ideas. You may want to show the best sketches as a transparency and get a class consensus on two or three of the best park designs. The following questions may be helpful in stimulating discussion:
   a. What ideas did you have about the arrangement of the areas?
   b. What ideas did you have about where to locate the structures?
6. Have each student write his name on his sketches and notes, paper-clip the sheets together, and hand them in. File and store the sketches for use in Activity 13A.

Homework

None

50

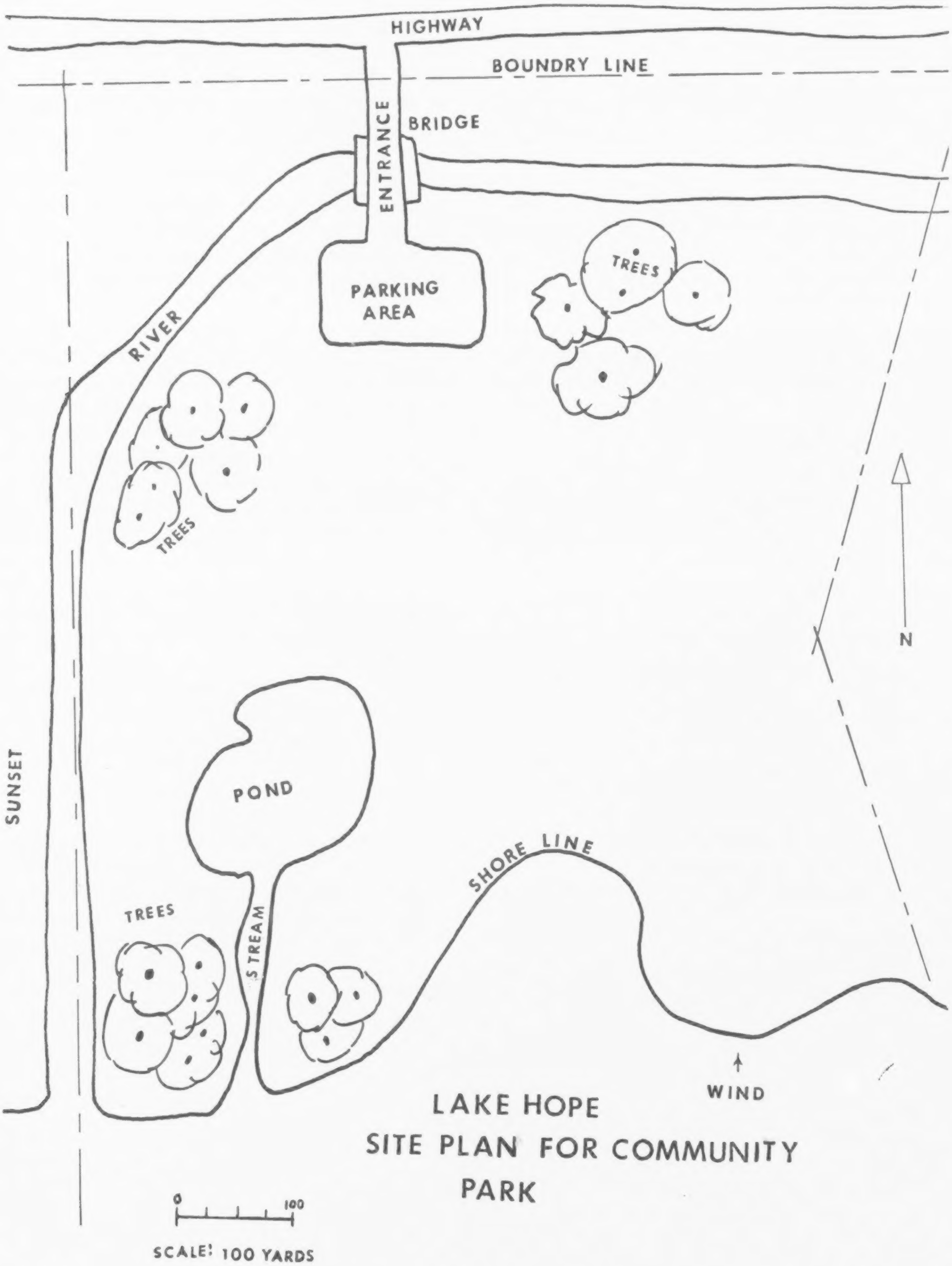
HIGHWAY
BOUNDRY LINE
ENTRANCE
BRIDGE
PARKING AREA
RIVER
TREES
TREES
N
TREES
SUNSET
POND
SHORE LINE
STREAM
WIND
LAKE HOPE
SITE PLAN FOR COMMUNITY PARK
0
100
SCALE: 100 YARDS

Fig. 21-1. Reproduction of Transparency 21-2

ASSIGNMENT 22, UNIT 12B

Developing Preliminary Ideas

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the problem of designing a community park, develop preliminary ideas for one of the areas or one of the structures.

Time Schedule

5 Overview
40 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Per teacher)

1	overhead projector/screen

Supplies (Per teacher)

1	Transparency 22
1	grease pencil

Supplies (Each student)

3 pcs.	8½" x 11" tracing paper*
2	paper clips

Supplies (Per group)

1	file folder (to store sketches)

*Have additional tracing paper available at your desk.

Overview (5)

Today you will develop preliminary ideas for one of the park areas or one of the structures. You will be sketching your ideas of either an area or one of the structures for the community park.

Laboratory Activity (40)

Each student will select a park area or structure for development.

1. Distribute tracing paper.
2. Students are to work individually.
3. Show Transparency 22, Grid Sheet. Select an area or structure from Fig. 12B-1 or Fig. 12B-2 for the Laboratory Manual. Explain how to count off the number of units and sketch in the items listed under the areas or structures. Follow the directions in the Laboratory Manual.
4. Answer any questions that the students may have. Students are working on the same community park site as the day before, but they are taking a closer look at the areas and structures.
5. Walk around the room and give suggestions on how to improve the sketches and ideas.
6. During the last 10 minutes of the period, select students to tell about their ideas. Show the best sketches as a transparency and comment on the design ideas. Students will get to see a variety of ideas and how they are presented.
7. Have each student print his name on his sketches, paper clip the sheets of tracing paper together, and hand them in. File and store the sketches for use in Activity 13B.

Homework

Reading 13

ASSIGNMENT 23, UNIT 13A

Refining Ideas

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to refining ideas:
   a. Explain what dimensions and activities need to be studied to design a classroom for music activities.
   b. List some things that could go wrong if a designer did not carefully work out the music room sizes and dimensions.

Discussion

2. Given a demonstration on scaling a parking area, define the terms: proportion and scale.

Laboratory Activity

3. Given the proportions for the park areas and structures:
   a. Draw a refined sketch of the location of areas and structures.
   b. Plan the walkways to connect the areas.

Time Schedule

5	Overview
10	Lecture
5	Discussion
25	Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1	overhead projector/screen
1	12″ rule
1	grease pencil

Supplies

1	Transparency 23

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1	12″ rule

Supplies (Each student)

	All preliminary sketches from Activity 12A and B
2 pc.	$8\frac{1}{2}$″ x 11″ tracing paper
2	paper clips

Overview (5)

The third step of the design process is to refine your preliminary ideas for solving the problem.

1. In the text you read how preliminary ideas are refined by drawing the ideas to scale or proportion.
2. I will show you how to refine an idea for a parking area.
3. We will discuss my solution to the parking-area design problem.
4. Using the graph paper in the Laboratory Manual, you will refine your preliminary ideas for areas and structures.

Lecture (10)

Refining rough sketches serves several purposes and requires some drawing skills that may be new to the students. (Scaling was introduced in Assignment 11.)

1. The rough circles and other shapes that show your first ideas would be very misleading if you never refined them. The shapes are not exact.
2. A refined sketch should show the outline shape and relationship of each important part in proportion so that it matches the object drawn. For example, a floor plan sketch of a room would show the shape of the room in proportion. Proportion is the relationship of one size or shape to another. If a living room is twice as long as it is wide, then the sketch of that room should be twice as long as it is wide. (Show with a chalkboard sketch that measures 20″ by 10″.)
3. The proportions can be shown as a measurement. (Add dimension arrows and numerals on the chalkboard sketch to show a 20′ by 10′ room.)
4. When I drew this sketch, I used the scale 1″ = 1′. By scale, I mean the unit of length or distance used to represent a larger or smaller length. If I measured carefully when I drew the length and width of the room, and if the corners are square, then I have a scale drawing. (Measure the length and width of your chalkboard sketch. Correct it if neces-

sary.) I used a unit of 1″ to represent 1′ of room length.

5. The sketch I did on the chalkboard was *scaled down:* the drawing is smaller than the room. In most of your drawing activities you will scale down the lengths and distances.
6. If a drawing is larger than the object drawn, it is *scaled up.* Illustrate this by drawing a pencil to the scale of 4″ = 1″. Here I used a larger unit of length (4″) to represent a smaller length (1″).
7. When scaling is done correctly, all the parts of a drawing are *in proportion.* A playground that is very long and narrow will be drawn as a long, narrow area on a map.
8. To show you how a preliminary idea might be drawn in proportion, I will go over a problem that concerns a parking area. (Using Transparency 23, Designing a Parking Area, show the site for the parking area.)
9. Someone has studied the dimensions of many cars and trucks and the measurements of several parking lots. He has analyzed his data and decided on these requirements. (Read requirements from transparency.)
10. (Show the students how to begin refining the preliminary idea by laying out the area on the transparency grid.) Each small square on the grid represents 4 square feet of parking lot. If something is to be 12′ wide, I count off 3 of the small units on the grid.
11. When I talk about this scale drawing, I say that one small unit "equals" 4′. This is not really true in the mathematical sense. It is a special way that the word "equal" is used in scale drawings and maps. If the legend on a road map says that 1″ = 1 mile, it means that 1″ on the map *represents* or stands for one mile on a highway.
12. Now that I have the outside edge of the parking area drawn to scale, I plan the parking spaces and the aisles. (Continue with other details. Flip the overlay to show one solution.)

Discussion (5)

Review the meaning of proportion and scale.

1. What does proportion mean? (It is the relation of one size or shape to another.)
2. What are the proportions of this book? (Hold up book and give proportions of thickness, width, and length.)
3. What does scale mean? (A unit of length or distance used to represent a larger or smaller length.)
4. Is a road map scaled up or scaled down? (Scaled down, 1″ on the map may represent one mile of distance.)

Laboratory Activity (25)

The students will refine their ideas for a park area or structure and plan walkways to connect the areas.

1. Explain that the design requirements are proportions of lengths and widths of areas very much like the requirements you have been working with, but some of the dimensions are different.
2. Distribute equipment and supplies.
3. Give help as needed.
4. Toward the end of the period, you may want to show the best sketches as a transparency to show the various design refinements.
5. Collect and file all drawings for use in Activity 18.

Homework

None

ASSIGNMENT 24, UNIT 13B

Refining Ideas

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a list of design requirements for the park areas and structures:
   a. Draw a refined sketch of an area *or*
   b. Draw a refined sketch of a structure.

Time Schedule

5 Overview
40 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1 overhead projector/screen

Supplies (Each student)

All preliminary sketches
2 pcs. 8½" x 11" tracing paper

Overview (5)

Today you will continue refining your ideas for a community park by drawing a refined sketch of either a park area or structure. You can either work on the area you sketched in Activity 12B, or you can select a structure to refine.

Laboratory Activity (40)

The students will refine their ideas for areas and structures for the community park.

1. Return to students their preliminary ideas from Activity 12B for recreation facilities.
2. Tell the students to read all the directions before sketching.
3. Walk around the room and assist students as necessary.
4. Toward the end of the period, you may want to show the best sketches as a transparency to show the refined ideas.
5. Collect and file all drawings for use in Activity 18.

Homework

Reading 14

ASSIGNMENT 25, UNIT 14A

Analyzing the Design

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given a situation related to engineering a design for a neighborhood playground:
   a. Name what special *structural problems* should be considered.
   b. Name what *functional problems* need study before equipment is installed.
   c. Name what *site problems* need study before equipment is installed.

Discussion

2. Given a lecture-demonstration on determining the counterbalance weight for a bascule bridge, identify the data needed to solve the problem.

Laboratory Activity

3. Given the span dimensions of a bascule bridge and the location of the bridge's pivot point:
   a. Compute the weight needed to counterbalance a vehicle load on the bridge.
   b. Test the computation by constructing and counterbalancing a simple bascule bridge.

Time Schedule

5 Overview
15 Lecture-Demonstration
5 Discussion
20 Laboratory Activity

Equipment and Supplies for Lecture-Demonstration

Equipment

1 sawhorse *or* equivalent

Supplies

1 2" x 6" x 8' board
2 8" x 8" x 16" concrete block
4 bricks (used as weights)

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	12″ rule

Supplies (Class)

36	bricks
1	2″ x 4″ x 3′-6″ board
2	2″ x 4″ x 4′ board
2	2″ x 4″ x 8′ board
5	1″ x 4″ x 12″ board

Overview (5)

Today's lesson concerns the fourth step of the design process.

1. You read about the three main types of analysis involved in engineering a design: site analysis, structural analysis, and functional analysis.
2. Today I will show you how to do a structural analysis for a kind of bridge called a *bascule* bridge.
3. We will discuss the kinds of data you need to determine the counterbalance weight for a bascule bridge.
4. For the laboratory activity you will work in groups, calculating bridge counterbalance loads and testing your computations by constructing and counterbalancing a bascule bridge.

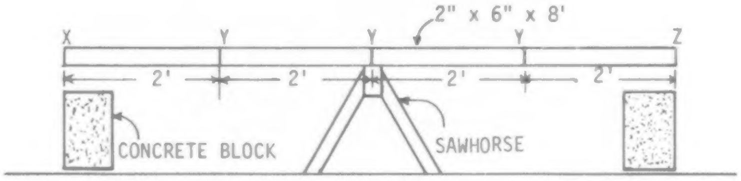

Fig. 25-1. Balance Beam Setup

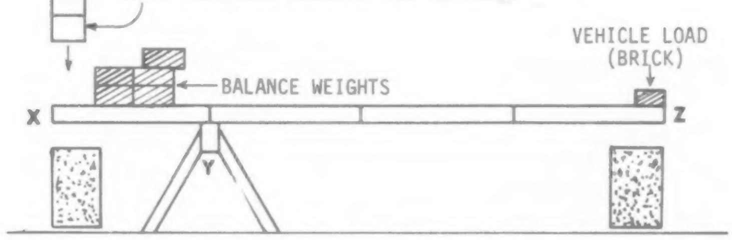

Fig. 25-2. Adding Balance Weights

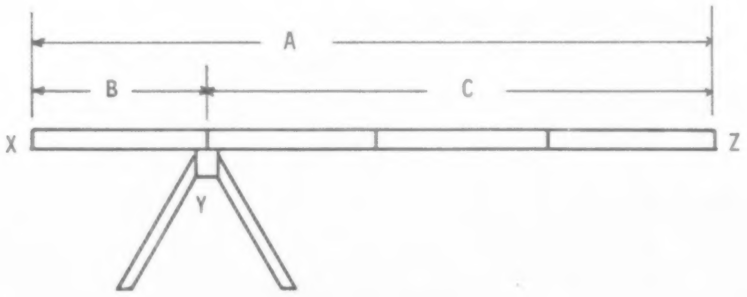

Fig. 25-3. Span Distances and Points

Lecture-Demonstration (15)

Before Class

1. Prior to class, mark a 2″ x 6″ x 8′ into 2′ lengths. Label the three central 2′ marks as *Y*. Label one end *X* and the other end *Z*. Set the concrete blocks in place. See Fig. 25-1. Balance the 2″ x 6″ on a saw horse or similar device. The board should be in a balance position when students enter class.

Balancing

2. This is a bascule bridge. A bascule bridge is one that has a pivot point (at saw horse) to allow one end to raise or lower. The saw horse represents the bridge pier or foundation. A bascule bridge is used on small rivers, such as the river or stream in the community park you have been designing. Each span must be able to tilt so that boats can travel on the river. (Teetertoter the 2″ x 6″). Why does the bridge balance? (Equal weight on both sides of the pivot point, fulcrum).
3. We can't have a pier in the middle of the river. We need more room for boats to travel. (Move the 2″ x 6″ to the *Y* nearest the *X* end—¼ the distance of the span. Let end *Z* drop to the block.) Why doesn't it balance? (Unequal weight). Add bricks at end *X* to balance the bridge.

Counterbalancing

4. Suppose that a heavy vehicle starts onto the bridge at *X* and drives toward the center. As it approaches point *Z*, it adds a great deal of extra load or strain. If the bridge is not engineered and built properly, the end *Z* could go down into the river under the vehicle load. To keep this from happening, extra weight is built into the span at point *X*. It is called a *counterbalance* load. The counterbalance load at *X* does not make the end go down, unless we want it to, because it can be supported from underneath.
5. If you are an engineer, you have to figure out how much extra weight is

needed to counterbalance the bridge before the bridge is built. (Place a brick at Z. This brick is the weight of the vehicle at the end of the bridge. See Fig. 25-2.)

6. How many units of weight (bricks) are needed at point X to counterbalance the weight of the vehicle?
7. The weight of the vehicle at X we will call V. The distance between X and Y we will call B. The distance between Y and Z we will call C. The distance between X and Z or the total span we will call A. (Draw Fig. 25-3 on the chalkboard.)

Computing

8. The span will balance if we can find the counterbalance weight needed at X. We know the C distance is 6 units, and the weight is 1 unit. We also know the B distance is 2 units but we don't know the weight. To find the weight we can use a formula.

$$W = \frac{V \times C}{B}$$

(Write the formula on the chalkboard.)

9. By substituting in the formula we can find the units of weight needed at X. Do the arithmetic:

$$W = \frac{1 \times 6}{2}$$

$$W = \frac{6}{2}$$

W = 3 units of weight

10. Thus, 3 units of weight (bricks) at X will counterbalance the vehicle at Z. (Add 3 bricks at end X. You may have to adjust the weight location slightly because all of the bricks cannot be stacked exactly at point X. See Fig. 25-3.)
11. You have problems like this in your laboratory activity with other number values. They can all be worked by this formula.

Discussion (5)

1. What kinds of data do you need to determine the weight that will counterbalance the weight of a vehicle on a bascule bridge? (Length of span, location of pivot point, vehicle load.)
2. What is the formula for determining counterbalance weight?

$$(W = \frac{V \times C}{B})$$

3. What do the letters in the formula stand for? (W = counterbalance weight, V = vehicle weight, C = distance of long span, B = distance of short span.)

Laboratory Activity (20)

Each student will determine a counterbalance weight needed for a bascule bridge and test his computation by constructing a simple bascule bridge.

1. Divide the class into groups of five. Assign each group one bridge-span problem to do from Fig. 14A-1.
2. Have students get the supplies needed for the activity.
3. Assist students as the need arises.
4. Review the students' answers with them. Correct any incorrect answers.
5. If additional time remains have students work another problem.

Homework

None

Answers for Laboratory Manual

Problem 1. Counterbalance load

1. 3
2. 3
3. 2
4. 3
5. 2

ASSIGNMENT 26, UNIT 14B

Analyzing the Design

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given a lecture-demonstration about determining a grade limit for a roadway, identify the data needed to solve the problem.

Laboratory Activity

2. Given the weight of vehicle in tons and the pounds of engine pull:
   a. Compute the grade limit for roadways made of concrete or blacktop, gravel, and sand.
   b. Test the computation by constructing and testing a simple road grade.

Time Schedule

5	Overview
15	Lecture-Demonstration
5	Discussion
20	Laboratory Activity

Equipment and Supplies for Lecture-Demonstration

The instructor will use the equipment and supplies needed for one group of students to demonstrate the procedures they will follow.

Equipment

1	overhead projector/screen

Supplies

1	Transparency 26

Equipment and Supplies for Laboratory Activity

Equipment (Class)

5 pr.	side cutter pliers
5	try squares

Supplies (Class)

5 pcs.	1" x 2" x 24" lumber
5 pcs.	1" x 2" x 3" block of wood
1 sp.	thread
1 box	paper clips
1 roll	masking tape
5 pcs.	1" of a 2" dia. pipe (approx. size)

Overview (5)

Today's lesson is again concerned with the analysis step of the design process.

1. Today I will show you how to do a functional analysis of a roadway grade (slope).
2. We will discuss the kinds of data needed to compute the grade limit for a roadway.
3. For the laboratory activity you will work in groups, calculating roadway grade limits and testing your computation by constructing and testing a simple roadway grade.

Lecture-Demonstration (15)

The procedures I will demonstrate are similar to those that you will use in the laboratory activity.

1. As you recall, the community park you have been designing had a requirement of a road from the parking area to the boat dock area. Assuming that the park has some hills, we need to figure out what the least steep grade would be to allow trucks or vehicles pulling boats and trailers to get to the boat dock area.
2. I will show you how to calculate (figure) the steepest grade or slope that a roadway can safely have. To do this the engineer needs to know what types of vehicles will use the road. From a chart or some other source, he gets the tons of weight for each type of vehicle and the engine pull, in pounds, for each type of vehicle. (Write this on the chalkboard.)
   weight of vehicle = ? tons
   engine pull = ? pounds
3. When engine pull (usable power) measured in pounds is divided by the "tons of weight" figure, the answer is "pounds engine pull per ton." Thus we have a formula: (write on chalkboard)

$$\frac{\text{engine pull in pounds}}{\text{tons of weight}} = \text{pounds engine pull per ton}$$

4. Let's add some figures to this formula and see how it works. Let's assume a small truck weighs 3 tons and has an engine pull of 1,860 pounds. (Substitute figures and work the problem).

$$\frac{1860}{3} = 620 \text{ lbs. engine pull per ton of weight}$$

   Now we need to find what this means in terms of the slope of hill it can climb.
5. Show Transparency 26, Grade Limit Graph, and demonstrate procedures. On

this graph, pounds of engine pull per ton runs up the vertical axis and grade limit runs along the horizontal axis. If you know the pounds of engine pull per ton of weight, you locate that figure along the left edge of the graph. In this example, the answer was 620 pounds. This falls between 600 and 700.

6. Move your pencil along the 620 pound line until you come to the diagonal line and stop. Now move your pencil straight down to the bottom edge. It will touch the percent grade line at about 3.1% for this example. Thus, the steepest hill that the small truck can climb is one that has a 3.1% grade. The truck cannot easily climb a steeper hill.
7. The problem I just worked was for a concrete or blacktop roadway. Your Laboratory Manual gives grade-limit problems for roadways constructed of concrete or blacktop, gravel, and sand.
8. In determining a grade limit for a roadway that several kinds of vehicles will use, the final decision will be based on the lowest grade. For example, if grade limit for a truck is 9%, for an automobile 10%, and for an automobile pulling a boat and trailer 8%, the roadway must not be more than an 8% grade.

Laboratory Activity (20)

Each student will figure the grade limit for three kinds of vehicles and three types of roadways and test their computations.

1. Divide the class into groups of five.
2. Have students get the equipment and supplies.
3. Assist student as the need arises.
4. Review the students answers with them. Correct any incorrect answers.

Discussion (5)

1. What kinds of data do you need to determine the grade limit for a roadway? (Vehicle weight in tons and pounds of engine pull in pounds.)
2. Do you think it would take more or less engine pull to climb a concrete road as opposed to a gravel road? (More) Why? (Greater friction to overcome between vehicle and ground.)

Homework

None

Answers for Laboratory Manual

Problem 1

Fig. 14B-2. Computing Engine Pull Per Ton of Weight

	Concrete or Blacktop		Gravel		Dirt	
Vehicle	Pounds Engine Pull per Ton	Grade Limit	Pounds Engine Pull per Ton	Grade Limit	Pounds Engine Pull per Ton	Grade Limit
Automobile	1760	8.7	1735	8.6	1700	8.5
Automobile, Boat & Trailer	860	4.3	835	4.2	800	4.0
Truck	1760	8.7	1735	8.6	1700	8.5
Grade Limit		4.3		4.2		4.0

ASSIGNMENT 27, UNIT 14C

Analyzing the Design

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

Given the test results from Activities 14A and 14B, prepare and present to the class a report of the findings from testing a model bridge counterbalance weight and a model roadway grade limit.

Time Schedule

5 Overview
40 Laboratory Activity-Discussion

Overview (5)

For the last several days you have been working on the fourth step of the design process, engineering the design.

1. You calculated the weight needed to counterbalance a load on a bascule bridge and the grade limits for three different types of roadways. The bridge problem was an example of a structural analysis, and the roadway problem was an example of functional analysis.
2. You tested your findings by constructing a model bascule bridge and making a model inclined roadway.
3. Your work in Activities 14A and 14B were similar to those conducted by engineers when they are analyzing a design for a bridge or roadway.
4. When the engineer has completed his analysis, he usually prepares and presents a report concerning his findings.
5. Today, working within your group, you will prepare a report. You are to identify your bridge span or roadway; tell if it worked and if not, why not; and explain how you performed your mathematical calculation.
6. You will then select one structural and one civil engineer from your group to present a 5 minute report to the rest of the class.

Laboratory Activity-Discussion (40)

1. Students are to work in their groups. Have three students from each group report on the bridge and two students report on the road.
2. They should be allotted 10 minutes in which to prepare their report.
3. Each group should select one person to present the reports to the class.
4. The following are questions to stimulate discussion:
   a. Was your bridge problem an example of a functional analysis or structural analysis? (Structural)
   Why? (Because structural analysis deals with strength, shape, size, di-

Fig. 27-1. Structures Requiring Engineering

Structure	Engineering examples
1. skyscraper and other buildings	structural frame, weight, wind resistance, strain, electrical circuits, plumbing systems, heating and air conditioning
2. tunnels	water or earth pressures upon the tunnel, vehicle exhaust, ventilation, entrance and exit points on opposite sides of hill
3. shipping piers	weights of freight upon pier, effects of tides, and pressures made by ships bumping the pier
4. communications towers	strengths of materials and construction for heights, wind resistance
5. highways and roads	expansion and contraction of surface material, grade, resistance to cracking, effects of weather, ice, salt, heat
6. bridges	span, weight, wind stress and strain, piers or supports, traffic control

mension and relationships. The bridge had parts of all of these.)

b. Was the roadway problem an example of a functional analysis or structural analysis? (Functional)
Why? (Because functional analysis deals with traffic flow, safety, operation, and maintenance. The roadway had parts of all of these.)

c. What type of engineer designs bridges? (Structural engineer)
Who do you think employs structural engineers? (Contracting companies, steel bridge manufacturers)

d. What type of engineer designs roads? (Civil engineer)
Who do you think employs civil engineers? (Contracting companies, state or local departments of highways.)

e. Do you know of any bascule bridges in our local area? Where are they? What other kinds of bridges are in the area? Is a highway overpass a bridge? (Yes)

f. Why do gravel or sand roads cause the engine pull of vehicles to be less than the engine pull on a concrete or blacktop road? (More friction to overcome between the road surface and the tire.)

g. Can you name other types of structures that require engineering? What would be engineered in these structures? See Fig. 27-1.

Homework

Reading 15

ASSIGNMENT 28, UNIT 15

Selecting the Design

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to selecting a design for a neighborhood park:
   a. Write some questions that a committee of businessmen, parents, teachers, and city officials might ask before they *decide* on a plan.
   b. State how you might use each of the following devices to help answer the committee's questions.
      1) *Models*
      2) *Photographs of similar projects*
      3) *Bar graphs and tables of figures*
      4) *Diagrams that show function or movement*

Laboratory Activity

2. Given the design requirements and construction specifications for a bascule bridge:
   a. Act as a design selection committee.
   b. Select the best bascule bridge design for the community park and present the selection to the class.
3. Given the design requirements and construction specifications for a roadway:
   a. Act as a design selection committee.
   b. Select the best roadway design for the community park and present the selection to the class.

Time Schedule

5 Overview
5 Lecture
35 Laboratory Activity

Overview (5)

1. Today the decision step of the design process will be studied. In the text you read that the final decision in selecting a design is a group process involving the designer and a design selection committee. The designer presents several design ideas to the committee. He may use models, flip charts, slides, pictures, diagrams, or graphs.

2. To aid you in your selection of a bascule bridge design and a roadway design, I will explain how to use the figures in the Laboratory Manual.
3. Three groups will work on the bridge design problem, select the best bridge design for the community park, and present their selection to the class. Two groups will work on the roadway design problem, select the best roadway design for the community park, and present their selection to the class.

Lecture (5)

Turn to Activity 15 in your Laboratory Manual: Selecting the Design.

Bascule Bridge

1. Figure 15-1 in the Laboratory Manual explains the bascule bridge design requirements. Figure 15-3 gives the bascule bridge construction specifications.
2. View A in Figure 15-1 explains how the terms "grade," "water level," and "depth of water" relate to the site conditions.
3. Figure 15-2 identifies the location of the bascule bridge site in the community park.
4. Figure 15-5, Span and Pier Distance, supplies you with the necessary dimensions to aid you in selecting the best bridge design.
5. In Activity 14A, you calculated and tested just one span of a bascule bridge. In today's activity, you must consider both spans. The most important measurement is the distance between piers, represented on Fig. 15-5 by the letter *X*. This distance must be greater than the width of the river.

Roadway

6. Figure 15-6 explains the roadway design requirements. Figure 15-7 gives the roadway construction specifications.
7. Figure 15-2 gives the topography of the site where the hill is located. The roadway *cannot go around the hill* so that the flat land can be used for playing fields.

Laboratory Activity (35)

You will have 10 minutes in which to select your best bridge design and roadway design for the community park.

1. At the end of 10 minutes, I will select the committees which will present their bridge design selections and roadway design selections to the class. You will have 5 minutes to present your selection to the class.
2. Assign the bridge groups to Problem 1 and the roadway groups to Problem 2.
3. Assist students as the need arises.
4. Have the committees report. Any difference in committee selections should then be discussed.

Homework

Reading 16

Answers for Laboratory Manual

1. The best bridge selection is Type 4.
2. The best roadway selection is Type 1.

Making Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to making working drawings for a neighborhood playground:
   a. Name the types of working drawings needed to explain the layout and construction details.

Discussion

2. Given a series of questions:
   a. State two reasons why working drawings must be dimensioned as well as drawn to scale.
   b. Explain why dimensions of separate drawings must be checked against one another.

Laboratory Activity

3. Given a set of contract working drawings, read the drawings and identify the following:
   a. The location of the house.
   b. The overall length and width of the house and garage.
   c. The scale of the left, right, and rear elevations.
   d. The depth of the concrete block foundation wall.
   e. The roof, detail and heating plans.

Time Schedule

5 Overview
10 Lecture
10 Discussion
20 Laboratory Activity

Equipment and Supplies for Lecture

The instructor will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Supplies (Group of 5)

1 set working drawings (8 sheets, All American Homes, Inc.)

Overview (5)

Today we begin the study of working drawings and how they are made.

Although we have been designing and engineering a community park, today we will look at a set of working drawings related to a house. To fully design the park, sooner or later the buildings in the park would need to be planned in detail so they can be constructed. Whether we look at working drawings of buildings on a park site or houses on a homesite makes little difference. For our purposes, there is little difference in how the drawings are made and what is on the drawings. All buildings have floors, walls, roofs, doors, a shape and size.

1. In your reading you were introduced to the seven types of working drawings, the reasons they are drawn to scale, and the need for accuracy on all the drawings (contract and shop drawings).
2. I will review the differences between contract and shop working drawings. I will explain the reason for accurate scaling and dimensioning, show you a set of working drawings, and identify the seven types of drawings.
3. We will discuss the difference between contract and shop working drawings, the reasons why working drawings must be dimensioned as well as drawn to scale, and why dimensions of separate drawings must be checked against one another.
4. Using a set of working drawings, you will identify the location of the house, dimensions of the house and garage, scale used for the elevation drawings, and the roof detail and heating plans.

Lecture (10)

1. The working drawings used on a construction project could be either contract or shop working drawings. Contract working drawings are made by the project architect and engineer and his consultants. They give the general physical description of the project. Shop working drawings are made by construction contractors or their subcontractors. They

show the details of how the parts fit together.

2. To be of any use, the working drawings must be accurately scaled and dimensioned because (a) this saves time for workmen so that they do not have to scale each part, and (b) they will build the project according to the dimensions shown on the drawing.
3. Display a set of working drawings. A simple set of working drawings usually, not always, includes the following: (a) site plan or plot plan, (b) foundation plan, (c) floor plan, (d) roof plan, (e) elevations, (f) sections, and (g) details.
4. More complex structures often demand subsets of detailed architectural, civil, mechanical, electrical, and structural drawings. There may be 50 or more pages of detailed drawings.
5. In very complex projects, separate sets of drawings may be made for heating, plumbing, and electrical systems. Otherwise, such systems are included on other drawings.
6. Drawings are made according to standards adopted by the United States of America Standards Institute (USAS), formerly the American Standards Association (ASA). The letters USAS are usually used instead of the whole name. USAS standards relate to the symbols, abbreviations, letters, and terms used on a drawing.
7. Drawings are made on tracing paper. They are reproduced as prints, in the numbers needed, for the city building department, for the contractor, for the various subcontractors, and for the workmen.

Discussion (10)

Use the following questions to encourage discussion:

1. Who makes contract drawings and shop working drawings? (Contract drawings are made by a project designer and his consultants; shop working drawings are made by a construction contractor and his subcontractors.)
2. What are some of the names used to describe various working drawings? (Basic types of drawings: site or plot plan, foundation plan, floor plan, roof plan, elevations, sections, details, heating. Subsets of working drawings: architectural, structural, electromechanical and heating.)
3. Why should drawings be accurately scaled and dimensioned? Give at least two reasons. (It saves time for workmen; they do not have to scale each part. The workmen will build the project according to the dimensions shown on the drawings.)
4. Why must dimensions on a drawing add up? (The part sizes must equal the overall length, width, and height measurements, or the structure will not be built correctly.)
5. Why should dimensions on one drawing in a set be checked against other drawings in the set? (For accuracy, to make sure all the parts will go together.)

Laboratory Activity (20)

Students will carefully examine prints of contract working drawings. They will answer questions about the prints posed in the Laboratory Manual.

1. Lay out one set of working drawings for each group.
2. Students are to answer the questions individually, even though they are sharing a set of working drawings.
3. At the completion of the activity, take several minutes to provide the correct answers to the questions in the Laboratory Manual.
4. You may want to have the students locate other parts and dimensions on the set of plans.

Homework

None

Answers for Laboratory Manual

1. East of Lot 261, North of Carrousel Drive, 26′ from sidewalk.
2. 50′8″ length and 40′0″ width, basement area 22′4″ x 32′0″.
3. Three bedrooms, 10′0″ x 10′7″, 18′7½″ x 22′0″
4. ⅛″ = 1′0″
5. Eleven (11) blocks deep
6. Sheet # 4
7. Kitchen elevation, stair section
8. Heating, 2 registers
9. 11 steps
10. No fireplace
11. Lavatory has no tub

ASSIGNMENT 30, UNIT 16B

Making Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given the term "site plan," identify what it is and why it is important.
2. Given the site contour lines, explain their relationship to the structure.
3. Given the local building code, explain its relationship to the placement of the structure on the lot.

Laboratory Activity

4. Given the contour map of a building site, locate, lay out, and sketch a structure to scale on a site plan, including compass orientation, driveway placement, and dimensioning.

Time Schedule

5	Overview
10	Demonstration
5	Discussion
25	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Supplies (Each student)

1	12″ rule
1	1½″ x 2½″ paper house (precut)
1	1¼″ x 1¼″ paper garage (precut)

Overview (5)

Today's material concerns the use of the site plan.

1. I will review with you the uses of contour lines and explain the importance of the site plan and the factors which influence the placement of the structure on the lot.
2. You will be asked to explain what the site plan is and why it is important. We will also discuss the part local building codes play in locating a structure on a site and the relationship between site contours and the structure.
3. Using a contour map, you will locate and draw a house and garage on a lot.

Lecture-Demonstration (10)

The site plan is very important to the construction contractor. It tells him where the construction site is located and where on the construction site to build the structure.

1. Have students look at Fig. 16B-1, Contour Map, in their Laboratory Manual. On the map you will notice contour lines. They show whether the land surface is flat, inclined, or steep. The elevation is given for each line, measured in feet above sea level.
2. Find the property boundary lines. It is shown by a long and short dashed line. The property line is marked with corner stakes. The elevations at those points on the map are shown with flags.
3. The placement of the structure on the lot is determined by local building codes. These codes determine the distance of building setbacks from the lot boundary line. (Demonstrate the placement of setback lines [setback] on the chalkboard.)
4. You may want to include easements to be drawn on the map, that is, land for municipal telephone lines, water mains, etc. that might affect the placement of the house on the lot.
5. The map also shows the compass position of the building lot. (Have students check the direction of Main Street and State Avenue.)

Discussion (5)

Use the following questions to encourage discussion:

1. What is a site plan? Why is it important? (It shows where the lot is located and where on the lot to place the structure.)
2. What part does the local building code play in locating structures on a site? (The code gives the distance of building setbacks from the lot line and the distances to allow for certain easements.)
3. What relationships are there between the site contours and the structure? (The site contours help to determine where on the lot it would be best to locate the structure.)

Laboratory Activity (25)

Given a contour map and other data, students are to sketch a site plan to scale for a given site. They should indicate compass orientation and dimensions of the buildings and lot. Taking the contour lines into consideration, they will locate a driveway.

1. Review the eight conditions regarding the site plan as given in the Laboratory Manual.
2. To make certain each student understands what is to be done, go over the four parts of the problem.
3. They should complete all four parts of the problem statement.
4. Distribute the house and garage cutouts. (These should be precut paper: for houses, 1½″ x 2½″; for garages, 1¼″ x 1¼″.)
5. Assist students individually as needed.

Homework

None

Answers for Laboratory Manual

1. Answers will vary with individual student's solution.

ASSIGNMENT 31, UNIT 16C

Making Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the design requirements for a garage, draw the foundation plan to scale and dimension the drawing.

Time Schedule

5	Overview
10	Lecture-Demonstration
30	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	overhead projector/screen

Supplies

1	grease pencil
1 set	Transparencies 31-1, 31-2

Equipment and Supplies for Laboratory Activity

Supplies (Each student)

1	pencil/eraser
2	paper clips
1 sht.	8½″ x 11″ paper

Equipment (Each student)

1	12″ rule

Overview (5)

Today's material continues the study of the different types of working drawings. The topic today will be foundation plans.

1. I will demonstrate how to draw the foundation plan for a garage similar to the one that was located on the site in Activity 16B.
2. You will also have an opportunity to draw the foundation plan for a garage.

Lecture-Demonstration (10)

In a set of working drawings for a construction job, the foundation plan is one of the most important drawings.

1. Show Transparency 31-1, Pictorial Drawing of Foundation. This is a pictorial drawing of a foundation for a garage. (Point out the following.) The earth has been cut away to show the foundation. The wall has been cut away to show the shape of the wall and footing. The grade line is the level of the earth around the foundation. Part of the foundation wall is above the grade line.
2. Flip overlay of Transparency 31-1. If we were to draw where the wall and footing lines are, it would look like this. That is, if we could look directly down on the foundation, we would see the edges of the wall and the edges of the footing. The edges, of course, are lines.
3. If we could look directly down on the foundation, we would see that the foundation does not have big and small corner angles. The corners are actually square. (Show Transparency 31-2, Garage Foundation Plan.)
4. Let's say that the design requirements call for a foundtion wall 8″ thick. How wide should the footing be? There is a standard formula that is used to determine the width and thickness of footings to make it strong enough to support the wall. On the foundation detail you see the wall thickness is marked with an X. If X = 8″, then ½ X = 4″. The footing lines are 4″ inside and outside of the wall. How thick is the footing? (8″).
5. The footing lines should therefore be drawn 4″ (in scale) on both sides of the wall. To keep from getting the wall line and footing lines from being confused, designers draw footing lines as dashed lines. Look at the top view of the detail; see how the dashed lines are drawn. (Flip overlay 31-2.) This is how the footing lines should look on a foundation plan.
6. To describe the size of the foundation, we use dimensions. Dimensions should be drawn at the bottom of the plan and to the right whenever possible. Notice that extension lines are short thin lines that extend from, but do not touch the drawing. Dimension lines run from extension line to extension line. They are also light lines which carry the size of the object. The ends of the dimension lines have small arrows. Notice that the title and scale are also included on this drawing.

Laboratory Activity (30)

Using the design requirements for a garage foundation, students are to draw the foundation plan to scale and dimension the drawing.

1. Be sure students understand that they are to draw the foundation plan on tracing paper placed over the grid, Fig. 16C-2.
2. They are to dimension the plan as they were shown in the demonstration.
3. Make certain that each pupil has a pencil, eraser, and a rule.
4. Walk around and give individual help when and where needed.
5. Collect the drawings near the end of the period.
6. You may want to show some of the drawings as a transparency.

Homework

None

ASSIGNMENT 32, UNIT 16D

Making Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the design requirements with the appropriate symbols, make a section drawing of a garage foundation to scale.

Time Schedule

5 Overview
10 Demonstration
30 Laboratory Activity

Equipment and Supplies for Demonstration

The instructor will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment

1	overhead projector/screen

Supplies

1	grease pencil
1 set	Transparencies 32-1, 32-2, 32-3

Equipment and Supplies for Laboratory Activity

Supplies (Each student)

1	pencil/eraser
2	paper clips
1 pc.	8½" x 11" tracing paper

Equipment (Each student)

1	12" rule

Overview (5)

Today's work concerns section drawings, one of the various kinds of working drawings.

1. I will demonstrate how to draw a section of the foundation of the garage you drew in Activity 16C.
2. During the laboratory activity, you will draw a section of the garage foundation.

Demonstration (10)

In a set of working drawings, section drawings may be needed to show the shape, size, and position of some part of the structure and to indicate the material from which it will be made. Section drawings explain these details more clearly than an exterior view using hidden lines. They make the invisible become visible.

1. Show Transparency 32-1, Pencil Section View. The word "section" sometimes means "cut." A section drawing is what you would see if you were to cut through an object. The cut surface lies in a cutting *plane*. On some drawings a heavy, dashed line shows one edge of the cutting plane. At the ends of the line, arrows point in the direction you would look to view the section. Indicate the cutting plane.
2. The outside of this pencil can be shown in plan view. However, the section drawing shows the interior of the pencil. It may also show the materials that will be used to manufacture the pencil.
3. In your laboratory activity, you will draw a section of the foundation you drew in Activity 16C.
4. Show Transparency 32-2, Foundation Wall Section View. This is a pictorial drawing of a corner of a foundation with the cutting plane marked. If we could remove part of the foundation and look at the part that was cut, it would look like this. Flip overlay.
5. Notice that symbols and notes are used to indicate the materials used and to name the parts of the foundation.
6. Show Transparency 32-3, USAS Symbols. These are some of the USAS symbols used to show different kinds of materials on a drawing. Point out the symbol and the material in the section, e.g. concrete: footing; gravel: under concrete slab.
7. This section drawing is very similar to the one you will draw in the laboratory activity.

Laboratory Activity (30)

Using the design requirements given in Fig. 16D-1 in the Laboratory Manual, students are to make a section drawing of a garage foundation to scale.

1. Point out that not all garage foundations are six blocks deep. The depth will vary according to the soil and frost conditions.

2. Students are to fasten tracing paper over the grid sheet (Fig. 16D-3).
3. Make certain each pupil has a pencil, eraser, and rule.
4. Walk around the room and give individual help as needed.
5. Collect the drawings near the end of the period.
6. You may want to show some of the drawings as a transparency to point out the similarity of drawings. Drawings of an object should convey the same information and meaning to any person looking at it.

Homework

None

ASSIGNMENT 33, UNIT 16E

Making Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the floor plan for a proposed room and porch addition, draw a foundation plan showing the foundation wall and foundation footing.

Time Schedule

5	Overview
10	Demonstration
5	Discussion
25	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	overhead projector/screen
1	12″ rule, with 16th's marked

Supplies

1	Transparency 33
1	grease pencil

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1	12″ rule with 16th's marked

Supplies (Each student)

1 sheet	8½″ x 11″ tracing paper
1	pencil/eraser
4	paper clips

Overview (5)

Today's lesson is about foundation plans.

1. I will demonstrate how to draw the foundation plan for a house.
2. In the laboratory activity, you will draw the foundation plan for a room and porch addition to a house.

Demonstration (10)

The foundation plan for a house is drawn much like the foundation plan for a garage.

1. Architectural draftsmen usually make foundation plans directly from floor plans by drawing on tracing paper laid over the floor plan. You will use the same technique in your laboratory activity.
2. Show Transparency 33. This is a floor plan of a proposed family room to be added to a house. This floor plan also appears in your Laboratory Manual. See Fig. 16E-1.
3. You will use this floor plan as a guide in drawing the foundation plan for the room and porch addition.
4. A footing is shown by a dashed line and a wall by a solid line. Make the footing extend beyond the foundation wall one-half the thickness of the wall.

5. Using Transparency 33, Proposed Room Addition Plan, demonstrate how to lay out the foundation plan.
   a. First measure out the distances representing the 8″ wide foundation walls. Use the inside of the frame wall as the centerline of the foundation wall. Using the scale ½″ = 1′, this means you will have to measure 3/16″ in both directions from the line. (Using 1/16″ markings, this approximates 4″ to scale.)
   b. Draw solid lines for the foundation walls.
   c. Measure out the distance representing the 16″ wide footing. Measure 3/16″ on both sides of the foundation wall. (This is double the approximated foundation wall dimension, scaled.)
   d. Draw dashed lines for the foundation footing.
   e. Flip overlay. This is how the finished plan would look.

Discussion (5)

1. How are foundation plan drawings for frame structures made? (By tracing directly from the floor plan.)
2. What kind of line (solid or dashed) should represent the footing? (Dashed.) The foundation wall? (Solid.)
3. As you work from a floor plan, what line helps you locate the center of the foundation for a frame structure? (Interior wall surface.)

Laboratory Activity (25)

Using the floor plan of the proposed room and porch addition (Fig. 16E-1) in the Laboratory Manual as a guide, students are to draw the foundation plan of the room and porch addition.

1. Distribute the tracing paper, 12″ rules, and paper clips.
2. Make certain that each pupil has a pencil with an eraser.
3. Students are to fasten tracing paper over the floor plan in the Laboratory Manual, using paper clips, and draw a foundation plan.
4. Walk around and give individual help when and where needed.
5. Collect the tracings near the end of the period. You may want to show some of the tracings as transparencies.

Homework

None

ASSIGNMENT 34, UNIT 16F

Making Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given several symbols for electrical fixtures, identify what each symbol represents.

Laboratory Activity

2. Given the floor plan for a house and an Electrical Legend and Fixture Schedule, locate the position of electrical fixtures on the floor plan.

Time Schedule

5	Overview
10	Demonstration
5	Discussion
25	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	overhead projector/screen

Supplies

1	Transparency 34

Equipment and Supplies for Laboratory Activity

Supplies (Each student)

1 sht.	8½″ x 11″ tracing paper
2	paper clips
1	pencil/eraser

Equipment (Each student)

1	12″ rule

Overview (5)

Today's material continues the study of the different types of working drawings. The topic today will be the electrical plan.

1. I will show you how to draw the symbols for the electrical fixtures which are planned for a house.

2. You will then have the opportunity during your laboratory activity to draw the electrical symbols to locate the electrical fixtures on a house plan.

Demonstration (10)

The electrical plan is very important to the building contractor and the electrician. It shows where to locate the different electrical fixtures.

1. On a simple construction project, the electrical plan is often included as a part of the floor plan. On complex construction projects, the electrical plan is a separate drawing.
2. Electrical plans may be very complex, but today we will cover only a few of the basic requirements.
3. Show Transparency 34, Electrical Symbols. Electricity is brought into the structure through an *entrance meter.* The meter is usually at the rear of the structure, but sometimes it is at the side. The symbol for the entrance meter is usually drawn like this. Show Transparency 34 and point out the entrance meter.
4. On the inside of the structure, near the entrance meter is the *distribution panel.* This panel directs the electricity through the structure with branch circuits. In structures with many appliances, there will be many branch circuits. Point out the distribution panel.
5. Convenience outlets (usually duplex) should be placed along the walls of all rooms so that an outlet is no farther than 5′ away from any one place along the wall. Here is the symbol for a convenience outlet. Point out convenience outlet.
6. Sometimes for heavy electrical appliances (240 volts) a higher voltage outlet is needed. It is usually represented like this. Point out electrical appliance outlet.
7. Switches are shown on walls by this symbol. Point out. A numeral 1 or 3 beside the symbol means that it is a 1-way or 3-way switch. Three-way switches control the same fixture from two different places.
8. Ceiling-mounted light fixtures are represented by small circles at the proper place. Point out ceiling fixture.
9. Switches and ceiling-mounted light fixtures are connected by electrical lines (short dash). If convenience outlets on walls are to be controlled by a switch, the same line is used.
10. There are many more electrical symbols, but the laboratory assignment will involve only the ones I have shown you.
11. An electrical legend and fixture schedule is usually used on large construction jobs where many special fixtures are to be installed. The one in your Laboratory Manual contains a description of each electrical fixture and the number required for each room. You will use this schedule as a guide in drawing your electrical plan.

Discussion (5)

Leave the transparency symbols on the projector and have a student identify each symbol as you ask the following questions. Cover the names with a sheet of paper.

1. What is the symbol for the entrance meter?
2. What is the symbol for a convenience outlet?
3. What is the symbol for a 3-way switch?
4. What is the symbol of a ceiling-mounted light fixture?
5. What kind of line shows switches connected with light fixtures and wall outlets? (A short-dashed line.)
6. How far apart should outlets be placed in any room? (About 10′. There should be an outlet no farther than 5′ away from any place along the wall.)

Laboratory Activity (25)

Using the Electrical Legend and Fixture Schedule in the Laboratory Manual as a guide, students are to draw the electrical plan for the house.

1. Students should paper clip the tracing over the floor plan.
2. Remind them that in laying out the convenience outlets around the walls, the outlets should be spaced 5′ to 10′ apart.
3. On the floor plan drawing, the ° in 13° x 10° means 13′0″ x 10′0″.
4. Walk around and give individual help as needed.
5. Collect the electrical plans near the end of the period.

Homework

None

ASSIGNMENT 35, UNIT 16G

Making Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given a lecture about staircase construction, state the difference between run and rise.
2. Given illustrations of conventional symbols, identify the symbols for concrete, earth, crushed rock, reinforcement rod, and reinforcement mesh.

Laboratory Activity

3. Given a set of stairway design factors:
   a. Compute the number of concrete stair risers and treads needed for a given rise.
   b. Draw the stairs.
   c. Use the appropriate symbols to indicate material.

Time Schedule

5 Overview
10 Lecture-Demonstration
5 Discussion
25 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Supplies (Each student)

1	pencil/eraser
2	paper clips
1 sht.	8½" x 11" tracing paper

Equipment (Each student)

1	12" rule

Overview (5)

Today's material continues the study of working drawings. Today's topic concerns the problem of drawing a staircase to scale.

1. I will demonstrate how to compute the dimensions for treads and risers for a staircase, and how to draw the staircase detailed drawing.
2. You will then have the opportunity to draw the staircase detailed drawing.

Lecture-Demonstration (10)

1. People who make working drawings usually must solve problems so that details may be determined. For example, there may be a 10′ vertical difference between two grade surfaces that are 12′8″ apart horizontally. The problem is: How many steps must be provided to reach from the lower to the upper level if each riser has a minimum height of 6″? (Draw the problem on the chalkboard. See Fig. 35-1.)
2. Using the illustration on the board, explain the terms *tread, riser, stringer, run,* and *rise.*
   a. The tread is the horizontal part you walk on.
   b. The riser is the material between tread heights.
   c. The stringer is the material that supports the treads and risers.
   d. The run is the horizontal distance from where the stairs start and stop.
   e. The rise is the vertical height between the top and bottom of the stairs.
3. To find the number of risers needed, we compute:

$$\frac{\text{total rise}}{\text{rise/step}} \quad \frac{10'0''}{6''} = \frac{120''}{6''} = 20 \text{ risers}$$

Risers are the vertical surfaces; treads are the horizontal surfaces (the steps you walk on). There is always one less tread than riser. Therefore, to find the number of treads subtract one from the number of risers.

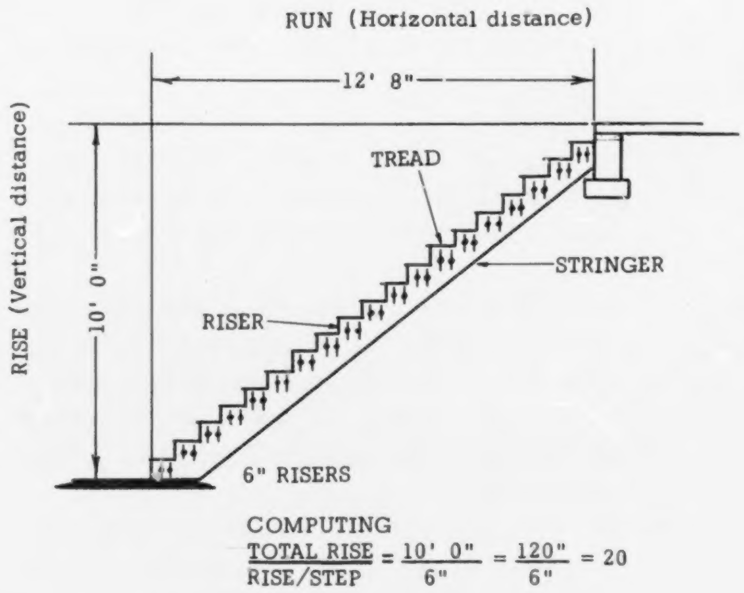
RUN (Horizontal distance)
12' 8"
RISE (Vertical distance)
10' 0"
TREAD
STRINGER
RISER
6" RISERS
COMPUTING
TOTAL RISE / RISE/STEP = 10' 0" / 6" = 120" / 6" = 20

Fig. 35-1. Stairway Problem

4. To find the tread width, we can divide:

$$\frac{\text{Run}}{(\text{No. of steps minus one})} = \frac{12'8''}{(20-1)} =$$

$$\frac{152''}{19} = 8''\text{ tread}$$

We will have 20 risers, each 6″ high and 19 treads, each 8″ wide.

5. Notes are descriptive statements used to explain what a material or condition is. Add some notes to the chalkboard drawing.

Discussion (5)

1. Using the staircase illustration on the chalkboard, have students indicate the difference between run (horizontal distance) and rise (vertical distance).
2. Have students identify from the chalkboard the common symbol for concrete, crushed rock, and reinforcement steel rod and mesh.

Laboratory Activity (25)

Using the Stairway Design Requirements (Fig. 16G-1) in the Laboratory Manual as a guide, students are to compute the number and size of stair treads needed for a given run and rise. Then they are to make a detail drawing, to scale, using appropriate symbols and notes.

1. Students should paper clip tracing paper over Fig. 16G-2. They should do their figuring on scrap paper.
2. Make certain that each student has a sharp pencil, eraser, and 12″ rule.
3. Walk around and give individual help as needed.
4. Collect the drawings near the end of the period. You may want to show them as a transparency.

Homework

Reading 17

ASSIGNMENT 36, UNIT 17A

Writing Specifications

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to writing specifications for a neighborhood playground:
   a. List some of the kinds of specifications needed to write about:
      1) General conditions
      2) General requirements
   b. Describe what you would do if some of the specified materials could not be purchased in your area.

Discussion

2. Given a series of questions:
   a. Identify three items that are specified in a set of specifications.
   b. Indicate where to find the information about plumbing fixtures for a structure when starting to write specifications.

Laboratory Activity

3. Given a plumbing fixture specification sheet and a builders' supply catalog, complete a plumbing fixture specification sheet by recording catalog number, description, and cost for each fixture.

Time Schedule

5	Overview
10	Lecture
5	Discussion
25	Laboratory Activity

Equipment and Supplies for Lecture

Supplies

1	builders' supply catalog

Equipment and Supplies for Laboratory Activity

Supplies (Group of 5)

1 (or more) builders' supply catalogs

Overview (5)

Today's topic concerns the writing of specifications.

1. In your reading you were introduced to specification writing.
2. I will explain how to write specifications.
3. You will identify at least three items that are included in a set of specifications and indicate where in the working drawings one should start looking for information to use in writing specifications.
4. You will then have the opportunity to complete a plumbing fixture specification sheet.

Lecture (10)

1. Specifications usually are written after or while the working drawings are being completed. The specifications are very important to the contractor especially because of the many kinds of materials and the range of sizes that might be used in constructing a structure. For example, plumbing fixtures vary in style, finish, operation, material, and cost.
2. Examples of plumbing fixtures are sinks, faucets, drains, disposals, showers, tubs, and toilets. Accessories are such items as towel racks, paper holders, toothbrush holders, shower doors and shower curtain rods.
3. The plumbing fixtures are partly determined by reading the detail plans of the structure. In your Laboratory Manual there is a plumbing fixtures specification sheet which lists the fixtures for a kitchen, bathroom, and a hall bathroom.
4. Other information about plumbing fixtures and uses can be determined by reading detail and section drawings.
5. The size, material, location, and type of plumbing fixture must be specified on the plumbing fixture specification sheet.
6. The plumbing fixture specification sheet is completed by locating each item in a builders' catalog and recording the catalog number, description, and cost.
7. It is the job of the specification writer to examine the possible selections and choose the appropriate number and type needed.
8. Cost is a major determining factor. The specification writer usually must work within an allotted maximum cost. If he goes over the cost he must revise his specifications to fall within the cost limit.

Discussion (5)

1. What kinds of information can be specified on a plumbing fixture specification sheet? (Room location, size, type, number needed, material, catalog number, description, and cost.)
2. Where can the information about plumbing fixtures for a structure be found? (In floor plans, details, and section drawings.)

Laboratory Activity (25)

Today students will complete a plumbing fixture specification sheet.

1. Students are to work in groups of five.
2. Distribute the builders' supply catalogs and help students locate the section on plumbing fixtures.
3. Using this section of the builders' supply catalog, each student is to complete the plumbing fixtures specification sheet for one group of plumbing fixtures: kitchen, bathroom, and the hall bath.
4. Make sure all students have pencil and eraser.
5. Circulate around the room to help students as need arises.
6. Toward the end of the period, record the range of costs on the chalkboard. The lower costs probably reflect lesser quality. Point out that quality can be controlled through specifications.

Homework

Activity 17B is optional. If it is used, there is no assignment; if 17B is not used, assign Reading 18.

ASSIGNMENT 37, UNIT 17B (OPTIONAL)

Writing Specifications

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a builders' supply catalog, complete a door specifications sheet by recording the catalog description, catalog number, and cost.

Time Schedule

5 Overview
40 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Supplies (Group of 5)

1 (or more) builders' supply catalog

Overview (5)

Today's material continues the study of specifications.

1. You will have the opportunity to complete a door specifications sheet.

Laboratory Activity (40)

Using the builders' supply catalog, students will develop a set of door specifications with a given cost.

1. Divide students into their work groups as before.
2. Distribute the catalogs.
3. The Laboratory Manual problem is self-explanatory.
4. Circulate around the room and help anyone having difficulty.
5. Toward the end of the period, record the range of costs on the chalkboard. The lower costs probably reflect lesser quality.
6. Point out that quality can be controlled through specifications.

Homework

Reading 18

ASSIGNMENT 38, UNIT 18

The Designing and Engineering Cycle

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to the designing and engineering of stage sets for a school play:
   a. Write some questions you might ask to help identify the *design problems.*
   b. List what dimensions you would need, before you start *drawing to scale.*
   c. Give reason why you need to know what the actors do on the stage.

Laboratory Activity

2. Given a design situation, a new set of design requirements and an unsatisfactory community park site design, redesign the park site in light of the situation and design requirements.
3. Given a series of drawings and a stapler, assemble the sheets into a set of drawings.

Time Schedule

5 Overview
40 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1 12″ rule

Supplies (Each student)

1 Site Plan for Community Park (from Activity 13A)

Equipment (Per class)

1 or more staplers/staples

Supplies (Per class)

All drawings from Activities 12A through 18
1 sht. 8½″ x 11″ tracing paper
2 paper clips
1 pencil/eraser

Overview (5)

1. Your text reading reviewed the designing and engineering cycle, as covered in Readings 10 to 17. You read that when new problems arise, the design must be adjusted in light of the new problem. The amount of change may include all or part of the design and engineering steps; that is, the design may be recycled through the whole process or any one step of the process.
2. Today you will have the opportunity to redesign your community park. Some problems have been discovered and your park designs need to be adjusted in light of the problem. Later today you will also assemble all of your sketch sheets into a set of drawings.

Laboratory Activity (40)

Students will be redesigning their community park design.

1. Hand out the park designs made in Activity 13A.
2. Have students get the necessary equipment and supplies.
3. Have students open their Laboratory Manual to Activity 18.
4. Read to the students the problem, design situation, and procedures from the Laboratory Manual.
5. Tell the students they have about 20 minutes to redesign the park.
6. After 20 minutes, stop the activity and show some of the sketches as transparencies. Show the "before" and "after" designs and comment on the solutions.
7. Distribute all of the drawings the students made in Activity 12A through 18. These can be compiled in order, titles labeled on them, a cover sheet made, and the drawings stapled together.

Suggested Drawing Sequence and Titles

Cover Sheet	Construction Drawings By *Name*
12A	Preliminary Ideas for Park (*Areas or Structures*)
12B	Preliminary Ideas for (*Name of Area or Structure*)
13A	Refined Ideas for Park Areas and Structures
13B	Refined Ideas for (*Name of Area or Structure*)
18	Design for a Community Park
16C	Garage Foundation
16D	Garage Foundation Section
16E	Foundation Plan for Proposed Room and Porch Addition
16F	Electrical Plan
16G	Stairway Detail

8. Students can now take their drawings home. You may want to display some of them on a bulletin board.

Homework

If optional Assignment 39 is used, select one of the alternatives. If it is not used, there is no homework.

ASSIGNMENT 39, UNITS 10-18
(Optional)

Review 10–18

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given the summaries of Readings 10-18, ask and answer questions about (a) designing and engineering construction projects, (b) identifying the design problem, (c) developing preliminary ideas, (d) refining ideas, (e) engineering the design, (f) selecting the design, (g) making working drawings, (h) writing specifications, and (i) the designing and engineering cycle.

Time Schedule

45 Discussion or Laboratory Activity

Discussion or Laboratory Activity (45)

This review time can be used in various ways. Plan to do one of the following alternatives.

Alternatives

1. Students can play the "Big Builder" game to become more familiar with the concepts and processes of construction.
2. Pose the questions and situations at the end of each reading to stimulate thinking and discussion.
3. Have each group of students get together and list two or three words or concepts they would like to have explained or discussed. Discuss and clarify the concepts.
4. Ask a guest speaker, knowledgeable about the design and engineering process, to talk to the class. Schedule the speaker for the first class period and tape record his talk as it can be played to your other classes.
5. Schedule a field trip to an establishment where designing and engineering are done.

Homework

None

ASSIGNMENT 40

Test No. 2

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given IACP Construction Test No. 2, select the correct responses from a list of items related to concepts presented in Readings 10 to 18.

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

1. Seat the students to best advantage for administering a test.
2. Distribute pencils, erasers, and eraser shields.
3. Distribute answer sheets and have students fill out needed information.
4. Pass out test booklets. "Keep closed until I say to begin."
5. Read directions for filling in answers. Open test booklets and begin.
6. Allow 35 minutes for completion; then collect answer sheets, then test booklets.
7. Review the test with students to provide feedback.

Homework

Reading 19

Answers for Test No. 2

1. A	2. C	3. D	4. C	5. C	6. C	7. A	8. C	9. D
10. D	11. B	12. B	13. B	14. D	15. A	16. A	17. A	18. D
19. A	20. B	21. C	22. C	23. A	24. A	25. B	26. C	27. C
28. D	29. A	30. D	31. A	32. C	33. A	34. B	35. C	

ASSIGNMENT 41, UNIT 19

Selecting a Builder

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to selecting a builder:
   a. Give reasons why most landowners hire a *general contractor* for a construction project.
   b. Give reasons why *general contractors* often hire subcontractors.
   c. Determine what kinds of payments are called for in different types of contracts.

Discussion

2. Given the lecture and Reading 19, describe the steps commonly followed in selecting a builder.
3. Given the lecture and text reading, state four contract choices available to an owner who is having a project constructed.

Laboratory Activity

4. Given a construction job, select an appropriate construction contract and give reasons why it was selected.

Time Schedule

5 Overview
10 Lecture
5 Discussion
25 Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1 overhead projector/screen

Supplies

1 Transparency 41

Overview (5)

Today's lesson concerns how an owner goes about hiring a contractor to do work for him.

1. The text explained bidding, choosing a contractor, and signing a contract.
2. Today I will talk about the four most common types of contracts and explain why each is used.
3. We will discuss the procedure followed by an owner in hiring a contractor.
4. For the laboratory activity you will be assigned to one of four groups, all competing for a big painting contract. Your group will study one type of contract and list its advantages. Then you will present the reasons why an owner should sign your contract.

Lecture (10)

The teacher should review the four kinds of construction contracts and motivate the students to know why each kind is used.

1. There are four common kinds of construction contracts. Show Transparency 41.
   a. Fixed price contract (FPC)
   b. Cost-plus-a-fixed-fee contract (CPF-FC)
   c. Cost-plus-a-percentage-of-cost contract (CPPCC)
   d. Incentive contract (IC)
2. Before a construction job begins, a contractor can only estimate how much equipment and material will be needed and how many hours of labor will be needed. A contractor who is competing for a job must set his bid high enough to cover all his costs for material and labor plus some profit for himself, but make his bid lower than the other bidders.
3. Show Transparency 41, Kinds of Construction Contracts. A contract that names a *fixed* (unchangeable) *price* for the whole job is called a *fixed-price contract*. This kind of contract has one advantage for the owner or buyer: he knows exactly what he must pay.
4. A contract that names a *fixed fee* to cover the contractor's profit is called a *cost-plus-fixed-fee contract*. In this case the contractor keeps a complete record of equipment, materials used, and man-hours of labor on the job. The total cost for all of these becomes the *cost* figure when the owner or buyer pays him.
5. Sometimes the contractor asks for a profit based on the cost. For example, he may charge 5% of whatever the cost turns out to be. This is a *cost-plus-percentage-of-cost contract.*
6. Sometimes it is important to the owner to have a construction job finished as soon as possible. Then he may sign an *incentive contract*—one that pays the contractor an extra bonus for completing the job early.
7. The major difference in the kinds of contracts involves the question, "who assumes the risk for the work not going according to plan?"
8. The following are examples of advantages for each kind of contract:

   a. Fixed price contract: The owner will never have to pay more than the original contract price, even if the contractor has unexpected costs for labor or materials. The contractor will make extra money if he finds ways to cut costs.
   b. Cost-plus-fixed-fee contract: The contractor does not pay anything extra if the project costs more than he had figured in labor or materials. The contractor's profit is untouched by rising costs of labor and materials.
   c. Cost-plus-percentage-of-cost contract: The plans do not need to be completely detailed in advance because, whatever the final cost, the contractor will be paid based on how much work was done.
   d. Incentive contract: Both the owner and the contractor can gain if the work goes well. Both can lose if it does not.

Discussion (5)

Answer questions from students. Then direct a discussion based on the following questions:

1. What are the steps commonly followed in selecting a builder? (a. Several contractors bid for the job. b. The owner selects a contractor, usually the lowest bidder. c. The type of contract between owner and contractor is determined and signed.) This is not *always* the procedure followed, but it is the most common.
2. Name one of the four contract choices that is available to an owner who is having a project constructed, and explain one of its advantages. (Lecture Item 8.)

Laboratory Activity (25)

Allow precisely 10 minutes' planning time and a total of 5 minutes for each presentation.

1. Divide the class into groups and let each group select the type of contract they think is best.
2. During the planning time, answer questions within the groups.
3. Schedule the time so each group has up to 5 minutes to present reasons why they think the contract they selected is best.
4. Award the contract.
5. Following the presentation, ask these questions.
   a. Which kind of contract names a set price that the owner will pay for the work to be done? (Fixed price contract)
   b. Which two kinds of contracts will tend to make the contractor work more

rapidly? (Fixed price and incentive contract)

c. Which two kinds of contracts assure the contractor of making a profit? (Cost plus fixed fee, and cost plus percentage of cost contract)

Homework

Reading 20

ASSIGNMENT 42, UNIT 20

Contracting

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to contracting:
   a. Name the kinds of information or documents that can show an owner or architect that a contractor is *qualified.*
   b. Give examples of what might happen if bids did not have to be responsive.

Discussion

2. Given the presentation on contracting procedures:
   a. Explain what happens when a contract contains false information.
   b. Explain who is responsible for the accuracy of contract documents and why accuracy is important.

Laboratory Activity

3. Given contracting procedures, bids, and a contract form:
   a. Select a bidder.
   b. Complete a contract form.
   c. Answer questions related to bid selection and contract accuracy.

Time Schedule

5 Overview
10 Lecture
5 Discussion
25 Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1 overhead projector/screen

Supplies

1 Transparency 42

Overview (5)

Today you will review the activities that lead to signing a contract for work to be performed.

1. In the text you read about advertising for bids, bidding, selecting a bidder, and signing the contract.
2. I will explain the procedure of contracting and tell you why a contractor may be accepted or rejected.
3. We will discuss what happens if incorrect prices are quoted on bids.
4. In the laboratory activity you will select a bidder according to contracting procedures.

Lecture (10)

The following is the procedure which leads from the invitation to bid to the notice to begin work.

1. Show Transparency 42, Contracting Procedures, and elaborate on each of the steps.
2. The invitation to bid is advertised.
3. The bids are received and opened at a specified date and time. Bidders not

meeting the requirements or "prequalifications" for bidding, as well as those not acceptable as reliable contractors, are rejected.

4. Assets of a company are sometimes used as a determining factor. In general terms, assets represent the value of a company's worth.
5. From the remaining bidders, the lowest bid is usually accepted.
6. A notice of award of bid is sent to the bidder.
7. Bonding of the contractor is arranged. Bonding is a guarantee by a bank or a security company that the contractor will perform his job as required by the contract or the bonding company will pay to have it done.
8. The contract is signed.
9. A notice to begin work is sent.
10. Any questions which arise will be settled by referring to the contract. Therefore, the contract and the documents which accompany it must be accurate and complete.

Discussion (5)

1. What will happen if a contract contains false information for work or materials? (Once the agreement is reached and signed, the contract is binding unless changed by mutual agreement.)
2. Who is responsible for the accuracy of the contract documents? (The signers of the contract.)

Laboratory Activity (25)

Have the students work individually to select a contractor from the three choices and then complete the contract form. The teacher may prefer to read through the bids aloud and begin the activity *as a group* in preparation to completing the contract individually.

1. Offer to help the students if they cannot understand their instructions.
2. Move about the class and help arrange for signatures by contractors and witnesses.

Homework

Reading 21

Answers for Laboratory Manual

1. Select Bid B
2. Answers vary.

ASSIGNMENT 43, UNIT 21A

Estimating and Bidding

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to estimating and bidding.
   a. Suggest the source from which a contractor or his *estimator* may get the following kinds of information:
      1) Sizes and kinds of materials needed
      2) Labor costs
      3) Equipment costs
      4) Overhead costs
   b. Give reasons that might cause a contractor to raise or lower the profit that is included in his bid.

Laboratory Activity

2. Given a plumbing plan, plumbing costs, and the option of installing either a galvanized or copper plumbing system, estimate which system will give you the most profit.

Time Schedule

5 Overview
10 Lecture
30 Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1	overhead projector/screen

Supplies

1	Transparency 43
1	grease pencil

Overview (5)

1. You have read some of the problems to be considered in estimating and bidding. The key to success in making a profit is the estimates of labor, materials, and equipment costs.
2. I will show you how to make an estimate.
3. During the laboratory activity, you will be an estimator for a plumbing contrac-

tor and your job will be to estimate which kind of plumbing system to install in order to give you the most profit.

Lecture (10)

1. As prices of labor, materials, and equipment change from year to year, you must keep up to date with the changes. Current price records are kept by the estimator and he uses these prices to figure the cost of a job. His getting the job will depend upon how close he can figure the actual cost of the job, plus a profit and yet be competitive with other estimates. Obviously you could not figure the cost of a new job with last year's prices, and stay in business long. You may get the job because your estimate is lower but the new price will not make any profits. You may even go in the "hole". The estimator uses "rule of thumb" quantities and costs to help him estimate.
2. Let's figure the cost of a single plumbing job. Show Transparency 43, Estimating Plumbing Cost. This is a part of a plumbing diagram. (Point out the *line*, *T's*, and *elbows*.) To estimate the cost of this job, we need to know the cost of materials and labor. Point out the costs.
3. How many feet of pipe are there? (30′) What is the cost? ($3.00)
4. How many T's are there? (1) What is the cost? ($.10)
5. How many elbows are there? (4) What is the cost? ($.60)
6. What is the total cost of the materials? ($3.70)
7. (Rule of thumb) A plumber can install 30′ of pipe and connections in an 8 hr. day. How many days will it take to do this job? (1)
8. If he earns $9.00 per hour and he works 8 hrs. he earns $72.00. We said the job would take 1 day so the labor cost is ____. ($72)
9. We add the labor ($72) and materials ($3.70) to get a total or estimate of ____. ($75.70)

Laboratory Activity (30)

The students are to estimate the cost and profit for a plumbing job.

1. Have students open their Laboratory Manuals to Activity 21A and follow the directions.
2. You may want to read through the problem as a group before they start their estimates.
3. Stop the activity about 10 minutes before the end of the class and read the answers. You may want to work the problems and point out where mistakes may have been made.

Homework

None

Answers for Laboratory Manual

Fig. 21A-2 Cost Estimate

Line	*Galv.*	*Copper*
1	120=$18.00	120=$30.00
2	10=$1.00	10=$2.00
3	6=$.90	6=$1.80
4	$19.90	$33.80
5	30′	40′
6	120/30′=4	120/40′=3
7	32	24
8	$9.00	$9.00
9	$288.00	$216.00
10	$19.90	$33.80
11	$307.90	$249.80
12	$400	$400
13	$307.90	$249.80
14	$92.10	$151.20

Costs

Materials

pipe $.10 per ft x ____________ = ____ cost
(no. of ft.)
T's $.10 each x ____________ = ____ cost
(no. of pieces)
elbows $.15 each x ____________ = ____ cost
(no. of pieces)
____ total cost of materials

Labor

Plumber can install 30′ of pipe per 8 hr. day $\frac{\text{feet in line}}{30'}$ = ____ no. of days
Plumber's wage $9.00 per hour x 8 hr.
day = $72.00 per day x no. of days = ____ labor cost
____ materials
____ total estimate

ASSIGNMENT 44, UNIT 21B

Estimating and Bidding

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a "Big Builder" game:
   a. Become familiar with the terms and sequence of the managed production system.
   b. Compete against opponent players in bidding for construction jobs and gaining the most profit.

Time Schedule

5 Overview
40 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Group of 4 to 6 students)

1 "Big Builder" game
Note: Preassemble gameboards prior to class.

Overview (5)

1. In Reading 21 you read about estimating and bidding. In Activity 21A you did some estimating but no bidding. Today you will play a game called "Big Builder" in which you will do some bidding.
2. *Whether or not you win or end up with a profit depends on how well you bid.*

Laboratory Activity (40)

The following directions should help you conduct the gaming session. The students do not need their Laboratory Manuals today.

1. Preassemble five or six gameboards prior to class. You may already have these from Assignment 8 or from Reviews.
2. Distribute the games, rules, bid and balance sheets, playing pieces, etc.
3. Have the students follow along as you read the instructions.
4. Emphasize the importance of becoming familiar with the construction process (sequence of steps around the board).
5. Start the play. Demonstrate how to "Bid" and conduct "Transferring the Project" when these steps of the game come into play.
6. Near the end of the period, identify who the "Big Builders" are.
7. Store the games neatly. Make sure all of the pieces are turned in so the next class can play.

Homework

If optional Assignment 45 is used, there is no homework. If it is not used, assign Reading 46.

ASSIGNMENT 45, UNIT 21C (OPTIONAL)

Estimating and Bidding

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a room plan, painting costs, and the option of painting the room by brush or by roller, estimate which painting technique will give you the most profit.
2. (Optional). Given a "Big Builder" game, compete against opponent players in bidding for construction jobs and gaining the most profit.

Time Schedule

5	Overview
40	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Group of 4 to 6 students)

1	"Big Builder" game

Note: Preassemble gameboards prior to class.

Overview (5)

1. So far you have done estimating and bidding.
2. Today you can choose to do another estimating problem, a little more difficult than the last one, or play "Big Builder."
3. Have students vote as a class to do one or the other, or let each student decide which he wants to do, be an "estimator" or "bidder."

Laboratory Activity (40)

1. Students who select the estimating problem will need their Laboratory Manuals. You will need to supply "Big Builder" games to students selecting this activity.
2. Group the students accordingly. Have the "estimators" follow the procedures in the Laboratory Manual. Have the "bidders" get out the gameboards.
3. Near the end of the period, review the answers with the "estimators." Identify the "Big Builders" in the class.
4. Store the games neatly.

Homework

Reading 22

Answers for Laboratory Manual

Line 6.	550 sq. ft.
Line 7.	41 sq. ft.
Line 8.	509 sq. ft.
Line 10.	3.4 hrs., 2.0 hrs.
Line 12.	$15.64, $9.60
Line 14.	$21.64, $15.60
Item 12.	Roller
Item 13.	$25.60

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ASSIGNMENT 46, UNIT 22

Scheduling

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to scheduling,
   a. Suggest what might happen if a contractor made these errors in *scheduling:*
      1) The inside walls were plastered and painted before an electrician arrived to install wiring.
      2) The kitchen walls and floor were finished before the plumber did his work.
      3) A truck arrived with ready-mixed concrete, but the forms to hold the concrete were not built.
   b. Suggest some other *scheduling errors* that might be very expensive mistakes.

Discussion

2. Given an explanation of a bar chart and a CPM chart (critical path method):
   a. Name some types of construction jobs that require scheduling.
   b. Explain the purpose of scheduling and what each type of chart provides.

Laboratory Activity

3. Given the problem of scheduling, using a bar chart and CPM chart:
   a. Schedule the operations of a job according to the sequence in which they should occur and the time required using the bar chart technique.
   b. Schedule the deliveries of materials using the CPM chart.

Time Schedule

5 Overview
10 Lecture
5 Discussion
25 Laboratory Activity

Overview (5)

Today you are going to work with two types of scheduling practices employed by the construction industry.

1. The text explained how a bar chart is used for scheduling. The operations of the critical path method also were explained.
2. During the lecture I will further explain each of these scheduling practices.
3. You will be asked to explain the purpose of scheduling and what each type of chart provides.
4. During the laboratory activity, you will perform a scheduling job on a bar chart and also schedule deliveries by the critical path method.

Lecture (10)

1. Have students open their Laboratory Manuals to the bar chart (Fig. 22-1) and the critical path chart (Fig. 22-2). The bar chart is a record of tasks and the time needed to do each one. It provides a check on what tasks should be completed at any time during the job.
2. The critical path chart does not show any information about time, but only the order in which each part of the job takes place. It does contain a delivery schedule which is not a part of the bar chart.
3. Explain and discuss other influences on scheduling or reasons for falling behind schedule which may come from these sources:
   a. Architect—changes in design, sizes, materials, location
   b. Subcontractors—their overall changes in scheduling production
   c. Engineers—changes in materials and structural design
   d. Owners, purchaser—changes in cost
   e. Unions—changes in labor wages
   f. Suppliers—changes in grades, supply deadlines, costs
4. Explain and discuss some of the reasons for falling behind schedule:
   a. Bad weather
   b. Labor problems (wage, contract, hours, etc.)
   c. Inability to get tools, materials, and equipment
   d. Equipment breakdown

Discussion (5)

1. What kinds of construction jobs require scheduling? (Any construction job.)
2. What is the purpose of scheduling? (It shows the plan of when certain processes are done, what order they are done in, and the time it takes to do them.)

3. What does each type of schedule show? (Bar charts show time information and activity progress. CPM shows activity progress, and delivery time.)

Laboratory Activity (25)

Each student is to fill in the bar chart and schedule deliveries on the CPM chart.

1. The student is to schedule a total of 12 hours' time so as to complete the job of repairing a city sidewalk. (See answers to Problem 1.)
2. Students should shade in the proper time slots to show how they will schedule each phase of the job. Point out that concrete should be ordered early.
3. Using the critical path chart, the students are to schedule deliveries to the proper jobs on the chart. (See answer to Problem 2.)

Homework

Reading 23

ASSIGNMENT 47, UNIT 23

Working as a Contractor

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to working as a contractor:
   a. Identify some of the *responsibilities* a contractor has other than making sure the correct materials are used.
   b. Name which of the following groups, in a contractors office, you would choose to work in and explain why you chose it:
      1) Administrative
      2) Engineering
      3) Construction

Discussion

2. Given information from a lecture:
   a. Explain why a contractor should be concerned about his reputation.
   b. Explain why ethics are important.

Laboratory Activity

3. Given a problem, decide whether to use materials other than those specified or wait for the required material and pay a fine.
4. Given problems arising from the decisions made in the first problem, make two other decisions.

Time Schedule

5 Overview
10 Lecture
5 Discussion
25 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Per teacher)

1	overhead projector/screen

Supplies (Per teacher)

1 set	Transparencies 47-1, 47-2, 47-3

Overview (5)

Today's lesson concerns construction contractors.

1. You read in the text about a contractor's responsibilities and about how a construction company is organized.
2. Today I will tell you about some of the

responsibilities that a contractor must consider when he has decisions to make.

3. We will discuss the importance of a contractor's reputation and ethics.
4. During the laboratory activity you will play the role of a contractor and be involved in making decisions that could affect your reputation.

Lecture (10)

Today we will discuss the significance of decisions that a contractor may make. We will emphasize how decisions can affect the relations between a contractor and his customer or between a contractor and his workers.

1. To make a decision to do cheap work usually leads to a poor finished job. In the long run, the contractor will not make much money.
   a. It can cost a contractor his reputation.
   b. It will be more expensive because the contractor will be called back to repair faulty work, possibly replace it at his expense.
   c. Workers do not like to work with poor materials or do poor work.
2. Ethics are unwritten rules of conduct or moral duty. They serve as guide lines in making the right decision. Here are some of the ethical rules that a good contractor follows:
   a. He attempts to give the owner what he wants.
   b. He does not waste materials.
   c. He hires workers who will do a good job.
   d. He is honest in telling the workers what wages they will receive, what their job will be, and what their working conditions will be.
3. Why is a good reputation important?
   a. It helps the contractor to get business because owners and subcontractors will know they can depend on him to do a good job.
   b. It is useful in maintaining good relations with unions.
      1) Workers realize that they can trust the contractor to be fair with them regarding wages, working conditions, and jobs to be done.
      2) Unions are willing to send workers to him knowing the contractor will treat them fairly and not ask them to do an inferior job.

Discussion (5)

We will review reasons why it is important for a contractor to consider his reputation and ethics when making a decision.

1. Why should a contractor be concerned about his reputation?
   a. Getting future jobs will depend upon it.
   b. Most subcontractors and individual workers will not work for a contractor with a poor reputation.
   c. He will lose money through lack of work if his reputation is poor.
2. What are ethics? (What is good or bad, your moral duty and responsibility, your values of conduct.)
3. Why are ethics so important?
   a. They serve as guide lines for keeping a good reputation.
   b. The good reputation encourages a higher morale among workers and leads to satisfied customers.

Laboratory Activity (25)

(Note: Only the first problem is shown in the Laboratory Manual. You will present the rest of the problems as they are needed, from Transparency 47-1, Problems.)

Today's activity will show how important it is to make a sound decision when problems arise.

1. Read the situation to the class.

   Situation

   You are a contractor who does general concrete work. You have contracted to build a swimming pool for a customer who demands that you finish the job before a certain date. If you do not finish by this date, you must pay a penalty fee of $100.

   After you start the job, a serious problem comes up. A special concrete mix needed for the pool cannot be delivered until a week after the date you had scheduled it; thus, you will not finish the job on time.

   Remember that no matter what choice you make, its results will create other problems that you must solve. Remember also that after you have made a decision you must follow it and deal with whatever problems it creates. *You cannot change your mind.*
2. When this is clear, have students read the Problem 1 (Summary) and make

Decision 1 or A. They are to work individually and not discuss their answers until the end of today's activity.

Problem 1 (Summary)

You are informed that the special concrete used for swimming pools and the skilled workers will not be available until a week after you had scheduled the work. Thus you will not have the swimming pool completed on time. You must pay a $100 penalty if you do not meet the deadline.

Decision 1 or A

1. Wait for the special concrete and tell the owner why you will not meet the deadline.

A. Use a standard concrete which is available immediately and will enable you to complete the job on time.

3. After giving the students a few minutes to make Decision 1 or A, show Transparence 47-1 to present further problems, as follows.

4. Students who chose Decision 1 must solve Problem 2. Uncover Problem 2 on Transparency 47-1.

Problem 2

The owner gets angry because you are behind schedule and tells you he wants the job finished on time.

Decision 2-22 (Transparency 47-1)

2. You can order special concrete from a city 50 miles away and finish on time but the trucking cost will cut into your profit.

22. You can tell the men they have to work faster and hope you will not lose any profit. You can rent extra equipment and buy special concrete materials and mix the concrete yourself, thus cutting into your profits.

5. Students who chose Decision A must now solve Problem B. (Uncover Problem B on Transparency 47-1.)

Problem B

The standard concrete does not dry fast enough and exerts pressure on the forms, causing them to collapse.

Decision B-BB (Transparency 47-1)

B. You can hire more men to rebuild the forms, using heavier materials. The men and materials will decrease your profit on the job.

BB. You can rebuild the forms, using the same men and materials, and add a special mixture to the concrete which will harden it more quickly. The mixture is inexpensive, but it is not guaranteed.

6. After giving the students a few minutes to answer Problems 2 and B, present the next problem as follows.

7. Students who chose Decision 2 must now solve Problem 3. (Uncover Problem 3 on Transparency 47-1.)

Problem 3

Now that you have decided to order materials from 50 miles away, you must decide which of the following to hire:

Decision 3-33 (Transparency 47-3, Results)

3. Hire special concrete workers which will cost you the rest of the money you have left for a profit. You will finish on time with the job done correctly.

33. Hire unskilled labor which will still leave you with a profit. You will finish on time but the job may not be done correctly.

8. Students who chose Decision 22 must now solve Problem 4. (Uncover Problem 4 on Transparency 47-1.)

Problem 4

Now that you have decided to rent special equipment and buy materials to mix it yourself, you must decide which of the following to do:

Decision 4-44 (Transparency 47-3)

4. To finish on time you must tell your workers to work overtime even though they are not obligated to do so. This will cost you the rest of your profit and the job may not be done correctly.

44. Try to hurry your workers so they will finish during the normal working hours. This will leave you with a profit but may cause labor problems, and the job may not be done correctly.

9. Students who chose Decision B must now solve Problem C. (Uncover Problem C on Transparency 47-1.)

Problem C

Now that you have decided to hire more men and rebuild the forms with heavier materials, you must decide the following:

Decision C-CC (Transparency 47-3)

C. Hire skilled labor, which will cost you the rest of the money you have left for profit.

CC. Hire unskilled labor, which will still leave you with a profit.

10. Students who chose Decision BB must now solve Problem D. (Uncover Problem D on Transparency 47-1.)

    Problem D

    After using the regular concrete with the inexpensive mixture which you added to it, the concrete develops some cracks.

    Decision D-DD (Transparency 47-3)

    D. You can try to patch the cracks with a thin layer of cement.

    DD. You can start all over and pay $100 penalty.
11. Then tell them that you will now show them the decision-making process that they have been following.
12. Show Transparency 47-2, Decision Making. Point out to the class how each problem branched into two decisions until the eight possible results were arrived at.
13. Use an example to arrive at one result. Follow from Problem 1 to Problem 2, to Problem 4, to result 44 to show the example. Also explain that you will now discuss the results as is noted on the transparency.
14. Using Transparency 47-3, uncover one result at a time and discuss it with the class. After each result is discussed, cover it up and uncover the next one. It will be necessary for you to accept or reject results presented by the students that differ from any given on the transparency.

Homework

Reading 24

ASSIGNMENT 48, UNIT 24

Collective Bargaining

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to collective bargaining:
   - a. Give reasons why construction workers have special needs for help from a union.
   - b. Name what kinds of things union members and their employer bargain about.
   - c. State what a *mediator* can do to help *settle* a difference.
   - d. Describe what an *arbitrator* does.
   - e. Give reasons why a union tries to avoid a *strike.*
   - f. Identify the kinds of activities in which *labor* and *management* usually work together.

Discussion

2. Given information from a lecture:
   - a. State three disadvantages and advantages of unions.
   - b. Explain what could happen if there weren't any unions.

Laboratory Activity

3. Given a labor management contract problem and activity as either a labor or management member:
   - a. Give reasons why a new contract is or is not necessary when the old one expires.
   - b. Negotiate for contract acceptance.

Time Schedule

5	Overview-Lecture
5	Discussion
35	Laboratory Activity

Overview-Lecture (5)

1. In the text you read about collective bargaining and how unions bargain to get better working conditions for their members.
2. Today I will explain what can happen if collective bargaining is unsuccessful.

3. You will be asked to name some advantages and disadvantages of unions.
4. In the laboratory activity you will be a management or union member. As a union member, you will determine why a new contract is needed and bargain with management for its acceptance.
5. What is collective bargaining? It is group bargaining. Representatives of labor and of management try to settle their differences by negotiation; that is, they will discuss and talk over their differences and try to reach an agreement.
6. If collective bargaining is successful, labor and management are both satisfied, and work will continue.
7. If collective bargaining is unsuccessful, work may stop. Sometimes the workers go on strike.
8. When there is a strike, mediators and arbitrators come in and try to settle the dispute. Arbitrators are people selected as judges of a dispute. This may take a long time, during which many workers will be without work.

Discussion (5)

1. What are the advantages of a union? (High wages, good working conditions, shorter hours, and fringe benefits.)
2. What could happen if there weren't any unions? (Low wages, poor working conditions, long hours, no fringe benefits.)
3. What could be the disadvantages of a union? (High building costs, strikes, and the halting of work and pay.)

Laboratory Activity (35)

Today the students will represent labor and management.

1. Divide the class into two groups and assign each group to either labor or management.
2. Each group should read their contract and agreements. They have 10 minutes to decide upon a new contract.
3. Have the union spokesmen read their contract to the management group. Then have the management spokesmen read their contract. Determine the areas of disagreement. Both groups should join in a discussion to talk over their disagreements and present counter arguments. They have 15 minutes for the presentation and counter arguments.
4. Allow the group 5 minutes to reconsider their contract and decide on further action as indicated in the Laboratory Manual.
5. Have each group then present their decision. If time allows they can start the negotiation cycle again.

Arguments

a. The contract they have now is a good one.
b. They just signed the contract a year ago.
c. The cost of living has gone up for you too, and you are short of money.
d. You don't get paid extra for overtime; why should they?
e. Why do they need high retirement benefits when they have social security?
f. They should drive in car pools so that travel expenses will not cost more than 5 cents per mile.
g. They should be careful on the job; then they wouldn't need hospital insurance.
h. You work more than 50 hours a week, so why can't they work 40, 44, or 48 hours?
i. Don't they have any concern at all for your business?
j. Is money all they can think of?
k. If they go on strike, they won't have any income. Then what will they do?
l. If they go on strike, you will hire other people in their place.

Suggestion: You may want to tape the discussion if the equipment is available and play it back. This is a stimulant to the students. You may also want to send notes to some of the committee members to "spark" discussion.

Homework

Reading 25

ASSIGNMENT 49, UNIT 25

Hiring Construction Personnel

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to hiring construction personnel:
   a. Name several ways in which a construction contractor may *recruit job applicants.*
   b. Name the purpose of a *hiring hall.*
   c. Suggest what kinds of questions are usually asked on *job application blanks* and give reasons why the employer needs to know the answers.
   d. Give reasons why a contractor would want a new worker to know something about the whole construction project.
   e. Identify the kinds of *rules* and *policies* an employee needs to know.

Discussion

2. Given some information by the teacher:
   a. Explain what "recruiting" means.
   b. Give some reasons why the recruiting process may be long and expensive.
   c. Name some ways of obtaining information about a job applicant.

Laboratory Activity

3. Given the situation of applying for a job, play the role of (a) a personnel manager interviewing job applicants, or (b) a job applicant.

Time Schedule

5	Overview
10	Discussion
30	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

1 set (8) Personnel Manager cards
1 set (24) Job Applicant cards
1 set (8) Employment signs

Supplies (Each student)

1 pc. 8½" X 11" paper
1 pencil

Overview (5)

1. In the text you read about the three steps in hiring personnel: recruiting, selecting, and inducting.
2. During the discussion we will review the recruiting and selecting processes.
3. Your laboratory activity will involve job interviews. You will play the role of either a personnel manager or a job applicant.

Discussion (10)

The instructor should touch on some of the important aspects of recruiting and selecting construction personnel and should relate these points to the laboratory activity.

1. What does "recruiting" mean? (Finding and attracting people who are interested in your company and who qualify to become employees.)
2. Recruiting may be a simple process, or it may be complicated. Why is the recruiting process sometimes long and expensive? (It is often necessary to find special, well-trained men such as civil engineers, foremen, draftsmen, and skilled craftsmen. It may involve salary or wage negotiations before the prospective employee will take the job.)
3. Name some "instruments" or devices for obtaining information about a job applicant. (Application forms. Tests: proficiency, aptitude, trade, intelligence. Interviews. References. Personal value judgments.)
4. What does "selecting" mean? (Choosing a job applicant for a certain job.)
5. What does "inducting" mean? (Getting a worker acquainted with the work and the people he will work with.)
6. Do union contracts affect hiring procedures? (Yes. If there is a union contract, it puts limits on both the company and the worker regarding wages and hours.)

Laboratory Activity (30)

1. In the laboratory room arrange stations, each with an interview booth for the personnel manager and chairs for job applicants.

2. Have a "Men Wanted" sign at each station.
3. Shuffle the eight "Personnel Manager" cards with enough "Job Applicant" cards so that each student will get a card, with none left over. Have each student draw a card to learn his role.
4. Have each "Personnel Manager" go to the interview booth for his company.
5. In the case of a small class, have each job applicant select two job title cards so that all the cards will be used.
6. Give the students 20 minutes to do the interviewing and hiring, according to the directions in the Laboratory Manual.
7. Take a few minutes to find out who gained the most points as a personnel manager and who got the highest pay for each type of job. Have students use the remaining time to answer the questions in the Laboratory Manual.

Homework

Reading 26

Answers for Laboratory Manual

1. F
2. B
3. D
4. C
5. G

ASSIGNMENT 50, UNIT 26

Training and Educating for Construction

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to training and educating for construction:
   a. Name several *jobs** in each of these groups. *See Reading 20.
      1) *Managers*
      2) *Production workers*
      3) *Office workers*
   b. Identify which of these people usually work in *construction,* which usually work in *manufacturing,* and which work in both:
      1) *Aeronautical* engineers
      2) *Architects*
      3) *Civil* engineers
      4) *Electrical* engineers
      5) *Industrial* engineers
      6) *Mechanical* engineers
      7) *Sanitary* engineers
   c. Name who sets up and runs an *apprenticeship program.*
   d. Describe what you must do if you want to become an *apprentice* in a *construction trade.*
   e. State how much and what kinds of training are required to become a *journeyman.*

Discussion

2. Given information from a lecture, name some of the important elements of a good apprenticeship program.

Laboratory Activity

3. Given the problem of completing an apprenticeship program agreement:
   a. Indicate some of the requirements for a good apprenticeship training program.
   b. Find in a telephone directory the name of a potential employer.

Time Schedule

5 Overview
10 Lecture
5 Discussion
25 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

3	telephone directories (supplied locally)

Overview (5)

1. In the text you read about the importance of training in the construction industry as well as some of the training processes.
2. Today I will explain some of the important elements of an apprenticeship program.
3. During the laboratory activity you will complete an apprenticeship program agreement for a particular building trade.

Lecture (10)

1. Today we will examine the elements of a good apprenticeship program, and the make-up and functions of a joint apprenticeship committee.
2. The important elements of an apprenticeship program include the qualifications of the person to be hired. For example:
   a. His educational background (Varies, but usually a high school diploma is required.)
   b. His intelligence and aptitudes (Various tests are given throughout the 4-year training program.)
   c. His physical well-being (He must be physically able to perform tasks.)
3. Other major elements are the following:
   a. Length of training (4 years, in most cases.)
   b. On-the-job training (Instruction by a journeyman on the job.)
   c. Classroom instruction (Usually 144 hours per year of classroom instruction.)
   d. Wages of the apprentice (Begin at 50% of journeyman's wages in the area, then increase at the rate of 25% of the beginning salary every year. Nationally the average journeyman's wage is $4.00 per hour.)
   e. Hours of work and working conditions (These should be the same as those of the journeyman.)
   f. At no time should the on-the-job training of the apprentice interfere with the classroom instruction.
4. A joint apprenticeship committee should include in its makeup representatives of both union and management.
5. Functions of a joint apprenticeship committee include these:
   a. Deciding how many apprentices are needed.
   b. Deciding what standards for education, training, and experience are to be set.

Discussion (5)

1. What qualifications of an apprentice trainee are checked? (Formal education, experience, and health.)
2. Can you name some of the other important elements of a good apprenticeship program? (Length of training. On-the-job training. Classroom instruction. Wages and working conditions.)

Laboratory Activity (25)

Students will complete the sample apprenticeship program agreement.

1. Divide the students into their work groups, forming a mock "joint-apprenticeship" committee.
2. Assign each group a different building trade; for example, carpenters, plumbers, electricians, masons, sheet metal workers, plasterers, etc.
3. Have the foreman for each group serve as chairman and lead the discussion.
4. A chart in the Laboratory Manual describes several elements necessary for a good apprentice program. The instructor should guide any groups that need assistance in understanding the activity.
5. The students will discuss requirements and complete an apprenticeship program agreement by filling in the blanks in Fig. 26-2 of the Laboratory Manual.
6. Allow time for and inform students they are to answer questions at the end of the activity.

Homework

Reading 27

Answers for Laboratory Manual

Fig. 26-2
A. Answers vary
B. Four (4)

C. Will vary with trades
D. $2.00, $2.50, $3.00, $3.50
E. 1. same, 2. 144, 3. name of firm in your community

Sources of Information on Professions in the Construction Industry

For information on the training of civil engineers or architects, contact the admissions office of most colleges, universities, or technical schools.

For information on the Building Trades write:

American Federation of Labor and
Congress of Industrial Organizations
Building and Construction Trades
Department
815 16th Street, N.W.
Washington, D.C. 20006

Bureau of Apprenticeship and Training
U.S. Department of Labor
Washington, D.C. 20025

You may also contact the headquarters of the unions in the trade in which you are interested in your own city (their addresses and telephone numbers are listed in the Yellow Pages of your city telephone directory).

For general information, write:

National Association of Home Builders
1625 L Street, N.W.
Washington, D.C. 20006

Home Manufacturers Association
1625 L Street, N.W.
Washington, D.C. 20006

Associated General Contractors of
America, Inc.
1957 E Street, N.W.
Washington, D.C. 20006

ASSIGNMENT 51, UNIT 27

Working Conditions

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to working conditions:
    a. Suggest what parts of your classroom *physical environment* cannot be changed.
    b. Suggest some ways of improving the *physical environment* in your school.
    c. Suggest how group activities help you in getting an education.
    d. As fringe benefits,
        1) Name what tickets for sports events or entertainment you can buy at student rates.
        2) Determine if the school provides equipment for playing after-school sports.

Discussion

2. Given a series of questions:
    a. Name the three main aspects of the working environment.
    b. Name some safety factors that must be considered in the physical environment.
    c. Name some of the considerations for a good social environment.
    d. Name some of the considerations for the economic environment.

Laboratory Activity

3. Given a job title and a specific task, write a set of rules governing working conditions in the laboratory.

Time Schedule

5 Overview
10 Lecture
5 Discussion
25 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

It is suggested that you contact a local union and request several copies of the working agreement regulations between their union and a contractor's association. If these are made available to the students, they can gain a better understanding of what working agreements are all about.

Overview (5)

1. You read about working conditions and some of the items that affect these conditions such as rules and agreements.
2. I will tell you about some of the working conditions which play an important role in the worker's production.
3. We will discuss three main areas of working environment.
4. During the laboratory activity, you will be assigned a job title. Working in a committee, you will establish some agreements for working conditions.

Lecture (10)

Present the idea of being a productive worker and its effect upon progress in construction. Describe the following seven working conditions which play an important role in a worker's production.

1. **Absence:** Workers must account for being absent by following the proper procedure when they report back to work.
    a. Members will check with the foreman about making up work lost because of being absent.
    b. Absence due to illness shall be counted as sick leave time.
    c. After two days of being absent, a doctor's excuse is needed to receive benefits of sick leave.
    d. Members who are absent are responsible for telephoning the employer.
2. **Grievance Procedure:** Both parties (labor and management) agree that in cases where a member has a grievance, the following steps can be followed:
    a. Labor representative meets with representative from the employer.
    b. If no settlement, labor representative and business agent meet with general superintendent and a representative from the employer.
    c. If no settlement, make up a committee of three disinterested members to listen to both sides and make a ruling.
    d. If no settlement, teacher acts as an arbitrator.
3. **Reporting to Work:** On a construction project a worker may be needed for a day, for several days, or for many months. A union contract protects the worker from reporting to work and then being told, "You are not needed today."
    a. An employee who works on a day-to-day basis must be told in advance whether he will be needed for work on the following day.
    b. If the employer does not notify the employee at the end of a shift and the employee is scheduled for the next day's work, he must be given at least 12 hours' notice prior to the time he is to report to work. This must be done by calling him on the telephone.
4. **Safety Program:** All safety factors outlined in the working agreement must be rigidly followed.
    a. Safety goggles will be worn when operating any power machine or cutting hard materials.
    b. Workers must be protected adequately from dangers of fire, fumes, and dangerous chemicals.

Discussion (5)

From the reading assignment, the students should be able to identify three main aspects of working environment.

1. What are the three main aspects of the working environment that you read about in the text? (Physical, social, economic.)
2. What safety factors must be considered in the physical environment? (Hard hats, proper equipment and condition of equipment, safety goggles, etc.)
3. What are some of the considerations for a good social environment? (Whether employees get along with each other; whether planned and unplanned activities are available; whether the employer provides organized events or gatherings, or most activities are the outgrowth of common interest of neighborhood environment.) (All employers cannot offer formal, planned activities, since the field of construction, in many cases, dictates constant relocation to various building sites.)
4. What are some of the considerations for the economic environment? (Fringe benefits, insurance, retirement income, vacations with pay or without pay, seniority, wages, etc.)

Laboratory Activity (25)

1. Assign each student to a committee listed in Fig. 51-1 (Committee Tasks).
2. Tell the students to form committees based on their job titles, as directed in the Laboratory Manual. Have them read the directions that apply to their particular committee.
3. Give the students 15 minutes to complete their tasks. Then spend the remaining 10 minutes of the period having each of the committees read what they have written. You may want to use their suggestions to establish rules for better working conditions.

Homework

Reading 28

Fig. 51-1. Committee Tasks

Committee No.	Writing Tasks
1 Foremen	List the problems your group and other groups have had in getting work done. These might include problems of: getting and storing materials, working together in a group, how work will be done when a class member is absent, and other problems you have seen. Suggest a possible solution to each problem.
2 Timekeepers	Outline the routine you think that class members should follow in his starting and stopping work. Name some of the problems you have found and suggest solutions.
3 Equipment Supervisors	Name some of the problems you have found when getting out or storing equipment and materials. Suggest solutions on how these problems can be solved.
4 Safety and Grievance Men	Name some of the safety hazards in your laboratory and suggest what can be done about them. Make a list of safety rules you think should be obeyed in your laboratory.
5 Recorders	Name some of the problems you have had in recording and suggest possible solutions. Write the procedures to follow when a class member is late or absent. Who should he report to? How does he find out what work or information was missed?

ASSIGNMENT 52, UNIT 28

Advancing in Construction

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to advancing in construction:
   a. Compare how ambition and hard work are involved in both school and job *advancement.*
   b. Contrast how promotion to a foreman's job is different from promotion to the eighth grade.
   c. Explain the terms: *discharging, relocating,* and *laying off.*
   d. List what you would want to know about the *advancement practices* of a construction firm if you were looking for a permanent job.

Discussion

2. Given a lecture and series of questions:
   a. State the approximate number of years a person can expect to work after leaving high school.
   b. Name a determining factor in the type of work and amount of income an individual can expect during his lifetime.
   c. Name six factors that will affect a worker's earnings.

Laboratory Activity

3. Given lists of occupations and the approximate length of preparation time (schooling, apprenticeship), determine the approximate total incomes 5 years and 10 years after high school graduation.

Time Schedule

5 Overview
5 Lecture
5 Discussion
30 Laboratory Activity

Overview (5)

1. In reading about advancing in construction, you become familiar with career patterns, kinds of advancement practices, and effects of advancement.
2. I will tell you how education and apprenticeship training beyond high school can affect your lifetime earnings.
3. We will discuss some of the factors that can affect a worker's earnings.
4. During the laboratory activity, you will choose one of two occupations and determine the total income earned 5 and 10 years after high school graduation. You will also have an opportunity to compare some occupations, their requirements such as apprenticeship and schooling, and the income from each of them.

Lecture (5)

1. Have students get their Laboratory Manuals and open them to Activity 28, Fig. 28-1.
2. When an individual leaves high school, he can expect to work for approximately 40 to 50 years before he retires. The type and amount of education he has beyond high school will determine the type of work he does and the income he earns during his working life.
3. (Work the following problem on the chalkboard.) Let's say that you drop out of school and go to work at a car wash or grocery store for $1.25 an hour. Assuming that you work there for a year (2000 hrs.), you would make $2500.00 a year. In 5 years you would make $12,500 and in 10 years you would make $25,000.
4. Now let's say you stayed in school and went into an apprenticeship (a painter, for example). Find "Painter" in Fig. 28-1. A painter is an apprentice for 3 years and will make $3,950 the first year (50% of the journeyman's wage). This is $1450 more than the car wash job. In 4 years you would be earning about $7,900 per year. This is over three times as much as you would make as a car washer or grocery store stockboy.
5. The average earnings of technicians, professional men, and tradesmen are known, but many factors cause great variations in yearly incomes. Some of these factors are: where they are located, the state of the economy, bad weather, strikes, overtime, seasonal slow down, union vs. nonunion work.
6. Let's say you were interested in becoming an engineer. (See Fig. 28-3.) You would need 4 years of schooling after high school. After the schooling you could ex-

pect to earn anywhere from $8,000 to $15,000, depending on how good you were and where you worked.

Discussion (5)

1. Approximately how many years does a person work after leaving high school? (40 to 50)
2. What is the most important factor in determining the type of work and amount of income an individual can expect in his lifetime? (Type and amount of education.)
3. What are some of the factors that will affect a worker's earnings? (Where they are located, state of the economy, bad weather, strikes, overtime, seasonal lulls, union vs. non-union work.)

Laboratory Activity (30)

1. Students are to work individually on the laboratory activity.
2. Have them follow the directions in the Laboratory Manual. Let students select whether they want to figure the earning for a tradesman of their choice or a professional or semiprofessional.
3. Give them 15 minutes to complete these outlines.
4. During the last 10 minutes of the laboratory period, have the students report their total incomes for all of the occupations 5 years and 10 years after finishing high school. Compare and discuss the differences among the various occupations. (Education, apprenticeship, total incomes, etc.)

Homework

Assignment 53 is optional. If it is used, you may want students to bring in the textbook for Review 19-28. If it is not used, there is no homework.

Answers for Laboratory Manual

Fig. 52-1. Total Incomes

Occupation	5 Years	10 Years
Construction Laborer	$24,500	$49,000
Surveyor's Helper	18,500	37,000
Welder	30,000	60,000
Roofer	34,850	75,850
Lather	36,125	78,625
Operator of Heavy Equipment	36,000	84,000
Painter	33,575	73,075
Glazier	34,000	74,000
Cement Mason	35,000	77,700
Bricklayer	35,800	82,325
Floor Covering Worker	29,600	66,600
Sheet Metal Worker	33,200	74,700
Plasterer	34,800	78,300
Iron Worker	36,000	84,000
Carpenter	34,000	76,000
Electrician	36,000	84,000
Plumber, Pipefitter	36,000	84,000
Engineering Technician	14,300	58,800
Heating-Refrigeration Technician	14,300	58,800
Surveyor	15,000	50,000
Engineer	10,000	85,000
Urban Planner	0	78,500
Architect	0	85,000

ASSIGNMENT 53, UNITS 19-28 (OPTIONAL)

Review 19–28

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given the summaries of Readings 19 through 28, ask and answer questions about (a) selecting a builder, (b) contracting, (c) estimating and bidding, (d) scheduling, (e) working as a contractor, (f) collective bargaining, (g) hiring, (h) training, (i) working and advancing in construction.

Time Schedule

45 Discussion or Laboratory Activity

Discussion or Laboratory Activity (45)

This review time can be used in various ways. Plan to do one of the following alternatives:

Alternatives

1. Students can play the "Big Builder" game to become more familiar with the concepts and processes of construction.
2. Pose the questions and situations at the end of each reading to stimulate thinking and discussion.
3. Have each group of students get together and list two or three words or concepts they would like to have explained or discussed. Discuss and clarify the concepts.
4. Ask a guest speaker, knowledgeable about contracting and labor relations, to talk to the class. Schedule the speaker for the first class period and tape record his talk so it can be played to your other classes.
5. Schedule a field trip to a hiring hall or contractor's office.

Homework

None

ASSIGNMENT 54

Test No. 3

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given IACP Construction Test No. 3, select the correct responses from a list of items related to concepts presented in Readings 19 through 28.

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

1. Seat the students to best advantage for administering a test.
2. Distribute pencils, erasers, and eraser shields.
3. Distribute answer sheets and have students fill out needed information.
4. Pass out test booklets. "Keep closed until I say begin."
5. Read directions for filling in answers. Open test booklets and begin.
6. Allow 35 minutes for completion, then collect answer sheets, then test booklets.
7. Review the test with students to provide feedback.

Homework

Assignment 55 is optional. If it is used, there is no homework. If it is not used, assign Reading 29.

Answers for Test No. 3

1. D	2. C	3. A	4. D	5. D	6. A	7. C	8. C	9. B
10. B	11. C	12. D	13. A	14. C	15. B	16. B	17. D	18. A
19. C	20. B	21. C	22. A	23. B	24. C	25. A	26. C	27. D
28. B	29. C	30. D	31. B	32. A	33. D	34. A	35. A	

ASSIGNMENT 55

Optional

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

There is no text assignment or laboratory activity prescribed for the day's learning experience. Certain suggested activities are listed below which may be done for the students' benefit.

Suggested Activities

1. Yesterday the class was given a test. After you have graded the examination, you may want to go over it with the class.
2. Perhaps you have not completed all the laboratory activities suggested in the Laboratory Manual. You may want to perform one of the activities the class has not yet done.
3. Possibly you would like to devote the class period to a discussion of a topic related to parts of the test and the questions least understood.
4. You may wish to bring an outside speaker to talk to your class. Suggested topics of discussion are:
   a. The importance of safety in construction work.
   b. How construction personnel work together.
   c. The demand for skilled construction workers in today's economy.
   d. The importance of industrial arts education.

Homework

Reading 29

ASSIGNMENT 56, UNIT 29

Construction Production Technology

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to construction production technology:
   a. Identify what *preprocessing* is done to materials as they arrive on a site.
   b. Give reasons why a contractor does not want all the materials delivered to the site at one time.
   c. Name some materials that are *processed* by:
      1) *Separating*
      2) *Combining*
      3) *Forming*

Discussion

2. Given Reading 29 and a demonstration-lecture on construction production:
   a. State the construction practices that occur during the preprocessing stage of construction.
   b. State the kinds of construction practices that occur during the processing stage of construction.
   c. State the general procedure for constructing a structure.

Laboratory Activity

3. Given a list of production practices, classify them as preprocessing, processing, or postprocessing.
4. Given a list of processing practices, classify them as separating, forming, or combining.
5. Given the equipment and materials, construct a site box.

Time Schedule

5 Overview
15 Demonstration
5 Discussion
20 Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1 pr. scissors
1 stapler with staples

Supplies

5 sht. 8½″ x 11″ paper
1 pc. masking tape

Equipment and Supplies for Laboratory Activity

Equipment (group of 5)

2 claw hammers

Supplies (Group of 5)

4 pcs. 1″ x 3″ x 48″ (approx.) lumber*
30 6d common nails
1 pc. ½″ x 48″ x 48″ plywood
1 roll ¾″ masking tape

*Longer boards need not be cut. See Fig. 56-1.

Overview (5)

You have learned that the construction industry is a managed personnel-production system. For the next few weeks you will learn about the production of constructed projects. You will begin studying about the practices of production. (The first few classes should construct site boxes until there are five site boxes. The remainder of the classes should classify construction practices. *Or* you may want to have each class construct at least one site box rather than have them completed by only one class. The remaining students per class can classify construction practices while observing the construction of the site box.)

1. In your text you have read about the production of materials, how they are preprocessed, processed, and postprocessed.
2. I will demonstrate the three basic kinds of practices in which the form of a material is changed.
3. We will discuss the various activities and procedures in construction production technology as they pertain to preprocessing, processing, and postprocessing, commonly called *servicing*.
4. To help to understand these concepts, we will build some site boxes by changing the form of materials *or* classifying production practices.

Demonstration (15)

In today's demonstration the form of a material will be changed by a separating process, a forming process, and a combining process. (Note: before class, arrange your scissors and supplies on your workbench.)

1. Before the form of any material can be changed, the material must be brought to the work area. Doing this often requires some activity such as unpacking, handling, and protecting the material. These are preprocessing activities. They do not change the form of the materials but are essential for production.
2. When the materials and the equipment are ready, processing can begin. Today I am going to process a piece of paper, to make an airplane. I will demonstrate three ways to change the shape of the paper. They will represent the three basic kinds of practices that are used to change the form of any material.
3. Practices that change the form of a material without changing its mass are classified as *forming*. (Fold the paper into an airplane.) When I fold the paper, I make a change in the material's form. If you bent wire or pipe, plowed earth, or cast concrete, these would be examples of forming. (Complete the folding process.)
4. Now I will change the form of the paper by the practice known as *separating*. (Shear off the tail of the airplane to make a streamlined shape.) As a result of cutting, it now has a different shape. This activity can be classified as *separating*. If you sawed a board, sheared metal, or dug out earth, you would be performing

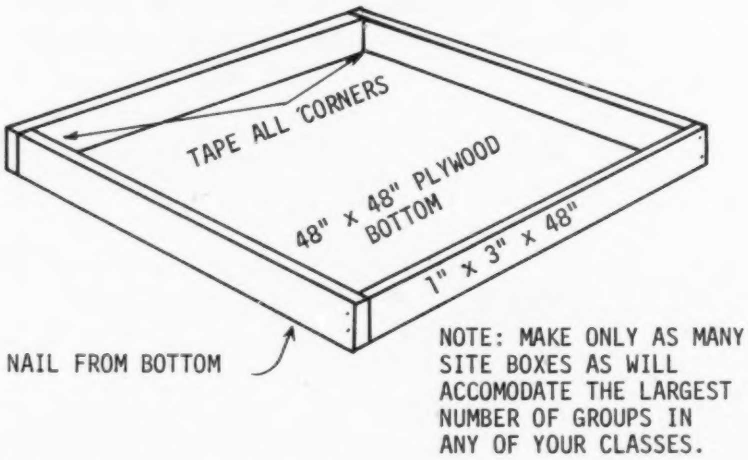

TAPE ALL CORNERS
48" x 48" PLYWOOD BOTTOM
1" x 3" x 48"
NAIL FROM BOTTOM
NOTE: MAKE ONLY AS MANY SITE BOXES AS WILL ACCOMODATE THE LARGEST NUMBER OF GROUPS IN ANY OF YOUR CLASSES.

Fig. 56-1. Site Box Construction

a separating practice. Some material is taken away from the rest.

5. In *combining*, materials are mixed or joined together. (Staple the center fold of the plane near the nose for weight and to hold it together.) If you laid brick, nailed boards together, or painted a wall, these would be examples of combining.
6. Now the airplane is complete. (Throw it.) However, products or projects need repairs as they age. (Retrieve the plane and punch a hole in the wing.) They also may need to be altered or may need some kind of installation or maintenance. (Tape a piece of masking tape over the hole in the wing.) This is known as repairing. Repairing is part of *postprocessing* or *servicing*. It involves the same kinds of activities that are used in processing if they are done after the product or project is completed.
7. Using scissors, cut a notch in the fuselage. This activity may be classified as *altering*.

Discussion (5)

The teacher should review the various procedures and practices used in construction production technology as they pertain to preprocessing, processing, and postprocessing.

1. What kind of construction practices can be classified as preprocessing? (Receiving, unpacking, handling, storing, and protecting.)
2. What kind of construction practices can be classified as processing? (*Separating:* taking away from material; *combining:* adding to material; and *forming:* changing the shape of a material without adding or removing material.)
3. What is the usual procedure in the production of a structure? (Clearing, surveying, earthmoving, setting foundations, erecting the superstructure, installing utility systems, enclosing [buildings only], finishing the structure, and landscaping the site.)
4. Does the basic procedure differ for the construction of a garage as compared with a television tower? (No. The same procedures are needed.)

Laboratory Activity (20)

Today's laboratory activity will be classifying construction practices *or* building a site box.

Site boxes (One Class Only)

1. Divide the class into their usual groups of five.
2. Assign each group to build a site box, Problem 2 in the Laboratory Manual.

Classifying Activity

3. Explain that you will write construction practices on the board and that they will have to identify whether each is a preprocessing, processing, or postprocessing practice.
4. Indicate that the students are to write the correct answers for all the terms in their Laboratory Manuals (Fig. 29-1). They are to write the term and check whether it is a preprocessing, processing, or postprocessing activity. See Fig. 56-1.
5. Point out that as soon as these terms are discussed the group will do the same thing for processing practices. They are to decide if these are separating, combining, or forming activities and these are classified in Fig. 29-2. See Fig. 56-2.

Homework

Reading 30

Production Practices	
Practices	**Classification**
1. storing materials	preprocessing
2. mowing the lawn	postprocessing
3. protecting materials from the weather	preprocessing
4. carrying a board	preprocessing
5. mixing sand and cement	processing
6. unpacking materials	preprocessing
7. repairing gutter downspout	postprocessing
8. sawing a board	processing
9. screening sand	processing
10. pumping water from site	preprocessing
11. replacing plumbing fixtures	postprocessing
12. painting a wall	processing
13. adding a room on the house	postprocessing
14. jointing plaster boards	processing
15. washing windows in the house	postprocessing

Fig. 56-1. Classification Answers

Production Practices	
Practices	**Classification**
1. screening sand	separating
2. bending copper tubing to conform to the shape of a wall	forming
3. mixing concrete	combining (mixing)
4. cutting metal with tin snips	separating
5. painting a wall	combining (coating)
6. bending thin plywood into an arc for forma	forming
7. seaming the plaster boards	combining (assembling)
8. crushing stone	separating
9. spreading plaster on wall	combining (coating)
10. drilling a hole	separating
11. putting putty around window glass	forming
12. sawing board	separating
13. bending metal flashing to fit between roof and chimney	forming
14. soldering copper tubing	combining (assembling)
15. putting oakum around the soil pipe joint	forming

Fig. 56-2. Classification Answers

ASSIGNMENT 57, UNIT 30

Getting Ready to Build

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to getting ready to build:
   a. Name the major *kinds of zones* in a city.
   b. Describe some other *restrictions* or limits that may apply in some areas of the city.
   c. Identify who must be *protected* at a construction site.
   d. Identify some dangers that workers must be protected from.
   e. Describe some ways in which the contractor provides for safety.

Laboratory Activity

2. Given a site box and a construction site plan:
   a. Locate buildings, water mains, telephone lines, roads, and property lines.
   b. Locate temporary facilities where they will be most efficient.

Time Schedule

5	Overview
10	Lecture
30	Laboratory Activity

Equipment Supplies for Lecture

The instructor will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment

1	overhead projector/screen

Supplies

1 set	Transparencies 57-1, 57-2, 57-3

Equipment and Supplies for Laboratory Activities

Equipment (Group of 5)

1 pr.	scissors
2	claw hammers
1	12″ rule

Supplies (Group of 5)

1	construction site box
4	buckets of sand
20	6d common nails
1	9 yd. string

Overview (5)

Today you will learn how to get ready to build.

1. In your reading you found out about zoning laws as they apply to certain locations, the safety and protection of people and property, how to get to the site, and providing for temporary facilities on the site.
2. In the lecture, I will talk about the different kinds of regulations that must be complied with and also about site planning.
3. We will then discuss certain things that were covered in your readings and clear up some points made in the lecture.
4. In your laboratory activity you will locate buildings, water mains, telephone lines, roads, and property lines in your site boxes according to a given construction site plan. You will also locate temporary facilities where they will be most efficient.

Lecture (10)

Today the presentation pertains to regulations and site planning.

1. **Zoning:** Before construction can be planned for a given site, it is necessary to find out if the size, shape, and use of the building agree with the building laws for the area. (Show Transparency 57-1, Zoning Map.)
   a. Each city or town usually is divided into zones with rules limiting what can be built in each zone. A large steel mill would be in a heavy industrial zone and a house in a single (or multiple) housing zone.
2. **Building Codes:** Structures must be constructed according to the building code of the area.
   a. The building code tells where a structure is placed on a lot. (Show Transparency 57-2, Building Placement.)
   b. The code also specifies the minimum size of the area at each side of the

structure, the height of ceilings, materials that can be used, thickness of walls, and construction procedures. The purpose of a building code is to make sure that the structure is safely built.

3. **Building Permits:** (Show Transparency 57-3, Application for Building Permit.) To make sure that the project follows the building code for a certain site, a building permit is needed. The building permit must be displayed so it can be easily seen each time the building inspector visits the site.
4. **Safety:** Safety is important at a construction site.
   a. Contractors want to avoid accidents to people and property because injury to humans, loss of materials, and loss or damage of equipment result in an increased cost of insurance, the loss of work time and lower worker morale. All of these are very costly to a contractor.
   b. Before construction begins, the contractor should put up warning signs and a barricade around the construction site to protect people, materials, tools, equipment, and the building under construction. This helps prevent damage to or loss of materials and equipment and makes it possible to check all workers entering the working area to see that they are wearing the necessary safety equipment.
5. **Facilities:** Before moving to a construction site, the contractor names a construction superintendent or foreman.
   a. One of the foreman's first duties is to assign temporary space for the storage of materials, tools, and equipment needed by carpenters, plumbers, and other tradesmen that will construct the structure. Space for the piling of earth and dumping of waste materials also is pointed out.
   b. Large structures such as dams, highways, office buildings, and industrial buildings usually require a roadway around the building area. A roadway from the nearest highway or street is also needed to get materials and equipment to the site. Deep trenches, soft earth, or dangerous work areas may require temporary walkways for construction workers.
6. **Utilities:** The local power, water, and telephone companies will have to be asked to provide temporary service during construction.

Laboratory Activity (30)

Today the student will identify and locate the temporary facilities, areas for storage, shelters required by the trades, and the utilities needed on the site.

1. Students will be working in groups of five. Have two members of each group do Problem 2 while the others do Problem 1.
2. Explain the directions to the students.
3. Point out that facilities on the construction site should be placed so that they take advantage of existing roads and utilities. You are to check the sites when the groups think they have an efficient site layout.
4. Tell students that when they are finished, they are to remove everything in the site box except the sand.

Homework

Reading 31

ASSIGNMENT 58, UNIT 31A

Clearing the Site

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to clearing a site:
   a. List the name or location of one structure or building that is in the process of being demolished in your neighborhood or city.
   b. Identify places where unwanted materials from demolished structures in your community can be placed or disposed.
   c. Find the names of two companies in your telephone directory that are involved in practices of "clearing the site."

Discussion

2. Given Reading 31, a lecture on clearing obstacles and some discussion questions:
   a. Name five factors which must be considered in clearing a site.
   b. Name six practices used to clear a site.
   c. Identify the proper practice to use for specific jobs in clearing a site.

Laboratory Activity

3. Given some obstacles which will interfere with a proposed construction project, identify the practice and equipment to be used for clearing the site.

Time Schedule

5 Overview
15 Lecture
5 Discussion
20 Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1 overhead projector/screen

Supplies

1 set transparencies 58-1, 58-2

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1 construction site box

Supplies (Group of 5)

1 set model obstacle kit*
2 cardboard box (small)

*Obstacles are to be set in place before class.

Overview (5)

Yesterday you were concerned with getting ready to build. Today you will learn about problems in clearing the site.

1. In your reading, you learned about (a) the important factors to consider in preparing a site for construction and (b) some practices used to clear the site.
2. In today's lecture I will tell you what is necessary to clear the site of any unwanted obstacles.
3. We will then discuss what you have read and any questions you may have.
4. In the laboratory activity, you will determine some practices by which selected obstacles can be removed from the construction site.

Lecture (15)

Today's presentation will concern what is necessary to clear the site of any unwanted obstacles.

1. The first thing the contractor must do is to decide what site factors will affect his work. Show Transparency 58-1, Site Factors Affecting Work. These site factors are:
   a. Size of the project
   b. Season of the year
   c. Rain and natural growth (grass, bushes, etc.)
   d. Man-made obstacles (buildings, bridges, etc.)
   e. Natural obstacles (boulders, rough land, small streams, mounds, caves, etc.)
   f. Location of the site (rural, suburban, city)
   g. Position of the project on the site (below ground level, above ground level, in water, above water)
2. Once the site factors have been noted, the contractor must decide what major site clearing practice to use. He can choose

one or all of the following: demolishing, salvaging, cutting, earthmoving, and disposing.

3. Show Transparency 58-2, Demolishing, and discuss each item as follows.
4. Demolishing means destroying.
   a. Blasting uses high explosives (dynamite, plastic explosives, nuclear devices)
   b. Wrecking is done with machinery (crawler tractor with bulldozer blade, wrecking balls or buckets, crowbar, chaining; use of two crawler tractors and chains to break down a stand of trees.)
5. Salvaging means saving something of value for future use.
   a. Cleaning (removing unwanted from wanted material)
   b. Storing, for sale (old bricks for new house, logs for fireplace)
6. Cutting practices include:
   a. Chopping (trees, shrubs)
   b. Sawing (trees or lumber, metal pipes)
   c. Flame cutting (cutting torch on steel structures)
7. Earthmoving practices include:
   a. Dozing (pushing earth and debris from one place to another)
   b. Shoveling (lifting and loading earth and debris)
   c. Dredging (sucking up earth or debris under water)
   d. Draining (making a trench to allow water to run out of a pond)
8. Disposing means removing from the site materials that are not wanted or needed on the site.
   a. Stockpiling (for later use on site as earth or sod)
   b. Burning (trash or timber)
   c. Burying (rocks, trash, bricks)
   d. Spreading (spread out gravel or earth piles in a thin layer)
   e. Hauling away (truck away trash or salvaged materials)

Discussion (5)

1. What are the site factors that must be considered when getting ready to clear the construction site? (Size of the project, season of year, rainfall, man-made and natural obstacles, location of the site, and position of the project on the site.)
2. What are the practices used when clearing the site of unwanted obstacles and materials? (Demolishing, salvaging, cutting, burning, earthmoving, and disposing.)
3. Here are some site clearing situations. Tell me which practice or practices are being described.
   a. There is a large boulder on the site that must be taken care of because it will interfere with earthmoving processes. What site clearing practices would be used? (Blasting and dozing.)
   b. There is an old home on the site. You want to keep the materials as you tear the house down. This is what site clearing practice? (Salvaging.)
   c. There is a group of unwanted trees on the site. These must be removed. What practice of site clearing will be used? (Cutting.)
   d. A pile of stones and a pile of rubbish stand on the spot where the building is to be located. These must be removed from the site. What practice of site clearing is this? (Disposing.)
   e. What other practice has not been mentioned? (Earthmoving.)

Laboratory Activity (20)

The students will determine the ways that a selected obstacle can be removed from the construction site.

1. Before class, the instructor will set up the obstacle situation in each site box. (See Fig. 31A-1 in Laboratory Manual.)
2. The students, working in groups, will determine the practice and equipment to be used in clearing the site. There should be time for the students to discuss how they would go about the site clearing process and why.

Homework

None

ASSIGNMENT 59, UNIT 31B

Clearing the Site

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given a lecture on removing and disposing of obstacles,
   a. Name three ways to dispose of extra earth.
   b. Name three ways to dispose of timber.
   c. Name three ways to demolish a building.

Laboratory Activity

2. Given an illustration of a building site and an efficiency chart which specifies costs, determine the most efficient technique for disposing of site obstacles and determine the cost of clearing.

Time Schedule

5	Overview
5	Lecture
5	Discussion
30	Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1	overhead projector/screen

Supplies

1	Transparency 59

Overview (5)

Yesterday you looked at the practices of clearing a site and the factors that must be considered before clearing can begin.

1. Today, I will tell you how to determine which objects are to be removed and the appropriate way to move them.
2. We will discuss some questions that you may have about today's lecture.
3. In your laboratory activity, you will try to determine the most efficient way to dispose of some obstacles and the cost of clearing a site.

Lecture (5)

1. Before site clearing can begin, it must be determined which obstacles are to be removed and the necessary practice to be used. The techniques of disposing are: stockpiling, burying, burning, spreading, and hauling away.
2. Show Transparency 59, Disposing, and briefly explain the following:
   a. Stockpiling is the storing of salvaged materials for future use. (Bricks, lumber, plumbing supplies, etc.)
   b. Burying means filling a hole with material, or covering up materials with earth fill. (Old construction material, etc.)
   c. Burning refers to the fire consumption of materials on the site. (Brush, trees, old lumber.)
   d. Spreading is the distributing of earth fill and top soil on the site.
   e. Hauling away means taking material from the site for disposal or for sale.

Discussion (5)

Use the following questions to direct the discussion.

1. Can you tell me three ways of disposing of extra earth? (Spreading, burying, hauling away.)
2. Can you tell me three ways of disposing of lumber or timber? (Burning, salvaging, hauling away.)
3. Can you tell me three ways of demolishing a building? (Wrecking, burning, salvaging.)

Laboratory Activity (30)

In the laboratory activity today, students will determine what clearing practice to use and determine the cost for disposing of some obstacles.

1. Explain that this is a group project and that the students will be using the simulated construction site in their site boxes as a guide.
2. Each group will determine the most efficient techniques for disposing of the obstacles.
3. Each group will then determine the individual costs of disposal and clearing. Allow time for groups to compare results.
4. Remind students not to remove anything from the simulated construction site box.

Homework

Reading 32

Note: See Assignment 60 for making up batter boards prior to class.

ASSIGNMENT 60, UNIT 32

Locating the Structure

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to locating the structures,
   a. Describe what you think would happen if a new home were incorrectly located and built on a portion of someone else's property.
   b. List three kinds of construction workers that would use surveying equipment to locate structures on a site.
   c. Describe a situation in which you could tell why surveyors were surveying.

Discussion

2. Given a demonstration on how to locate a structure on a building site, and discussion questions:
   a. State how the batter board locations are found on the construction site by a surveyor.
   b. Tell how batter boards are constructed.
   c. State how batter boards are used in locating a building.

Laboratory Activity

3. Given the equipment and supplies, a site box, and some string:
   a. Construct right-angle batter boards to be used to locate a structure on a simulated building site.
   b. Locate the outside walls of a building by running lines to points on the batter boards.
   c. Locate the four corners of a building by intersecting lines attached to batter boards.

Time Schedule

5	Overview
10	Demonstration
5	Discussion
25	Laboratory Activity

Equipment and Supplies for Demonstration

The instructor will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment

1	overhead projector/screen

Supplies

1 set Transparencies 60-1, 60-2, 60-3

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	hammers
1	plumb bob
1	12″ rule
1 pr.	scissors

Supplies (Group of 5)

1	site box with sand
74	6d box nails
*20 pcs.	1″ x 2″ x 12″ batter boards (salvaged from each class)
1	ball string

*Make up batter boards prior to class.

Overview (5)

Your work for the past two days has concerned clearing the site. Today you will learn how to locate the structure on the site.

1. In your reading, you learned about the importance of surveying and the techniques used in surveying for buildings and highways.
2. I will show you how to locate a structure on a building site.
3. We will discuss where and how batter boards are constructed and how the corners and "control points" are located.
4. In your laboratory activity, you will construct batter boards, locate the building lines, and locate the "control points" just as a contractor would.

Demonstration (10)

Today's presentation concerns how to locate a structure on a building site. (The instructor will explain how this is done and relate it to the laboratory activity. The demonstration will be done in one group's site box.)

1. One technique used to locate the corners of a structure on the building site is by using batter boards and lines.
2. The surveyor begins by locating the control points from which all horizontal and vertical distances are measured. He measures in from the property line by setting his transit at the required angles and measuring the required distances to locate the control points. These control points are located where they won't interfere with construction or with the construction equipment.
3. In your laboratory activity, the four corners of your site box will serve as the control points.
4. The batter boards are erected at the control points. (Show Transparency 60-1, Batter Boards.) There are two types of batter boards:
   a. Right-angle batter boards
   b. Straight batter boards
   The common one used is the right-angle batter board.
5. Batter boards are used to locate where the excavating is to take place, where the footings are to be located, where the line of the foundation will be, and where the four corners of the building are located. We will be concerned with the use of the batter boards for locating the four corners of a building.
6. Batter boards are constructed by driving three stakes into the ground and then nailing a horizontal crosspiece and support brace onto the stakes. The horizontal crosspieces must be level. (Show Transparency 60-2, Locating the Corners.) (The instructor should nail one completed batter board to a corner of the site box to show students how they are to do it in the laboratory activity. Disassemble the batter boards at the completion of the demonstration so that students will be able to use the site box for laboratory activities.)
7. Using the batter boards, the worker can locate the four corners of the building. This is done by running string between the batter boards. (Explain the reason for the nails on the batter board horizontal crosspieces.) He will then run the string from one batter board to another.
8. The string must be checked to make sure it is laid out accurately. (Show Transparency 60-3, Checking for Accuracy.)
9. The exact location of the corners is found by extending a plumb bob down from the point at which the strings intersect. (Shown on Transparency 60-2.) (Run a plumb bob from the string to the sand in the site box to show the students how this is done.)
10. The location of the corners is then marked with a wooden stake.

Discussion (5)

1. Where are the batter boards constructed? (At control points, located on the building site from the building site plan.)
2. How are batter boards used? (They are used to locate the corners of the building, footings, foundation, and excavation for the footings and foundation.)
3. How are the four corners located? (By running string between the batter boards.)
4. How are the building corners located? (By plumbing down to the ground and marking the point. This point is then staked.)

Laboratory Activity (25)

Groups of five students will locate a structure in the site box, using the batter-board technique. Note: The instructor should precut 20 pieces of 1″ x 2″ x 6″ pine for each group, to be used for the construction of batter boards. The teacher can make up the batter boards prior to class or have the first class make them. The following classes will then locate the structure.

1. Explain that in Problem 1 each group will be making four batter boards and nailing these to the site box.
2. Problem 2 is the locating of the building walls.
3. Problem 3 is the locating of the four corner stakes.
4. Explain that the various tasks will be assigned to different students. This is necessary because of the time factor.
5. To avoid the use of the same string nail by the second class, you can assign each group or class a different measurement such as 9″, 6″, 5″, 4″. See Fig. 32-1 in the Laboratory Manual.

Homework

Reading 33

ASSIGNMENT 61, UNIT 33A

Earthmoving

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to earthmoving,
   a. Identify one place in your neighborhood where earthmoving is now going on and tell why it is being done.
   b. Give reasons why you think earthmoving contractors like to have their equipment in use as many hours a day as possible.

Discussion

2. Given a lecture on earthmoving:
   a. State the three main steps of earthmoving.
   b. State three reasons for excavating a site.
   c. Identify the earthmoving equipment used to excavate.
   d. Identify the earthmoving equipment used to transfer and dispose.

Laboratory Activity

3. Given an earthmoving problem of filling a 100 cubic yard hole with compacted soil and a truck that can carry 10 cubic yards of soil, figure how many truckloads of soil are needed to fill the hole with the compacted soil.

Time Schedule

5 Overview
15 Lecture
5 Discussion
20 Laboratory Activity

Equipment and Supplies for Lecture

The instructor will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment

1 overhead projector/screen

Supplies

1 set Transparencies 61-1 through 61-6

Overview (5)

Yesterday's lesson concerned locating the structure. Today and tomorrow you will be concerned with earthmoving.

1. In your text, you read about transporting equipment and setting up equipment for earthmoving. You also read about seven kinds of excavations and how excavated material is transferred and disposed of.
2. Today I will explain some of the ideas that the textbook introduced.
3. We will then discuss the steps of earthmoving, why sites are excavated, identify the uses of earthmoving equipment, and identify the factors that affect equipment selection.
4. In your laboratory activity you will figure how many truckloads of soil it takes to fill a 100 cubic yard hole with compacted soil.

Lecture (15)

Today's presentation concerns earthmoving, a major process in the world of construction.

1. Earthmoving usually involves three steps: (list on chalkboard) *excavating*, *transferring*, and *disposing*.
2. Excavating has several purposes. Among these are the following:
   a. To reach a good base for a foundation.
   b. To make cuts through hilly land for travel routes.
   c. To level uneven terrain.
   (The balance of the presentation will deal with six transparencies.)
3. Let's look at some of the ways in which excavating is done.
   a. Show Transparency 61-1. *Loose bulk excavating* is moving material within the site. Material is not hauled away from the site but is piled in a new position. An example is the way soil is moved to make embankments to form a pond or lake.
   b. *Limited area excavating* is the vertical excavating of earth from pits, the sides of which must be shored because of the kind of soil being removed. Examples are drainage ditches and footings.
   c. Show Transparency 61-2. *Trenching* is excavating the earth from the surface down and across to a width sufficient to install conduits, pipes, or other un-

derground materials. The spoil (earth) is stockpiled next to the sides to be used later to refill the trench. Examples are sewer systems, water pipes, and underground electrical systems.
   d. *Tunnel excavating* is a type not usually listed under general excavation because it is done completely underground. The excavation is limited in width, depth, and height.
   e. *Dredging* is the excavation or removal of soils from under water, using the water as the way to transport the soil to its final position. It is similar to loose bulk excavation. Harbors, ponds, and swamps may be dredged.
4. Transferring excavated earth involves moving the earth from the excavation site to a nearby or a distant location where it is disposed of either by piling it up, by spreading it out, or by using it as fill material. Transferring and disposing are usually done together.
5. The earthmoving processes require many different pieces of equipment. Show Transparencies 61-3 to 61-6, Equipment, and the illustrations in the textbook to explain the uses to the students.
6. Several factors affect equipment selection by the contractor.
   a. Cost per hour: Does it cost less to use one type of machine than another?
   b. Soil types: Is the soil structure sand, clay, humus, or loam? Is the soil rocky or not?
   c. Site conditions: Is the site free of overhead and underground obstructions? Is the site free of debris? Is the surface of the site rough or smooth?
   d. Disposal of excavated earth: Is the excavated earth to be used on the site or is it to be hauled away?

Discussion (5)

Review with the students the process of earthmoving.

1. What are the three main steps of earthmoving?
   a. Excavating
   b. Transporting
   c. Disposing
2. Why are sites excavated?
   a. To reach a good base for a foundation
   b. To make cuts through hilly land for travel routes
   c. To level uneven terrain
3. (Question 3 is optional. If you have the time, use it.) What are the basic pieces of earthmoving equipment? Which ones are used for excavating and which for transferring and disposing? See Fig. 61-1.

Fig. 61-1. Earthmoving Equipment Uses

Earthmoving Equipment	Excavating	Transferring & Disposing
a. Power Shovel	x	
b. Dragline	x	
c. Clamshell	x	
d. Backhoe	x	x
e. Bulldozer	x	x
f. Scraper	x	x
g. Front end loader	x	x
h. Dredge	x	x
i. Trencher	x	
j. Hand tools	x	x
k. Dump truck		x
l. Stacker		x
m. Crawler tractor with sheepsfoot roller		x
n. Sump pump		x

4. What factors affect equipment selection?
   a. Cost
   b. Soil types
   c. Site conditions
   d. Disposal of excavated earth

Laboratory Activity (20)

Today students will work individually to solve an earthmoving problem.

1. Read through the problem with the students.
2. Explain that earth is not moved on a 1 to 1 basis; that is, excavated earth is increased in volume and compacted earth is decreased in volume.
3. Allow about 15 minutes to work the problems. Then discuss the importance of this idea to the earthmoving contractor. The following are suggested questions for discussion:
   a. Why did it take more than 100 cubic yards of natural soil to fill the 100 cubic yard hole? (Soil is compacted.)
   b. Why did it *not* take 14 truckloads or 20% more soil for compaction? (Because that 20% also compacts 20%; thus, about 14.4 or 15 truckloads were needed.)
   c. How would this kind of knowledge benefit an earthmoving contractor? (Affects cost, time, efficiency or best way to do the job for the least cost.)
   d. On what other kinds of construction jobs is earthmoving important? (Dams, tunnels, highways, park development, large buildings, etc.)

Homework

None

Answers for Laboratory Manual

9. 120 cubic yards of excavated soil
10. 15 truckloads

ASSIGNMENT 62, UNIT 33B

Earthmoving

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given an efficiency chart, equipment costs, and a graph to determine acres moved per hour:
   a. Determine the amount of earth per hour.
   b. Select the proper earthmoving equipment.
   c. Determine the equipment costs.

Time Schedule

5 Overview
5 Lecture
35 Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1 overhead projector/screen

Supplies

1 set Transparency 62-1, 62-2

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1 12″ rule

Overview (5)

Yesterday we discussed earthmoving. We talked about excavating, transferring, and disposing of the earth. Today we will continue the lesson on earthmoving.

In your laboratory activity, you will learn how to select the most efficient earthmoving equipment, how to determine the amount of earth moved per hour, and how to determine the equipment costs.

Lecture (5)

1. The cost per hour for a piece of equipment can usually be determined by the use of efficiency charts. For example, a piece of equipment with a 3 ft. wide blade traveling at three miles per hour can

cover 9/10 of an acre per hour. (Illustrate by using Transparency 62-1, Earthmoving Techniques.) Cost can depend on the amount of earth that can be moved in the least number of cuts or trips across the excavation site by a machine. Technique A shows time lost in backing up and turning. Technique B shows a constant forward motion, but less earth can be moved.

2. Show Transparency 62-2, Nomograph. By using the three columns together, the area of land that can be covered in an hour can be estimated. Select the width of the cut on Column C and the speed of the machine on Column A. Draw a straight line between these two points and read the area covered in an hour at the intersection of this line and Column B.
3. Cost can also depend on the size of the machine used. For example:

   No. of trips × amount of earth per trip = total earth, in cubic yards, per hour

   5 × 2 cubic yards = 10 cubic yards of earth per hour

   5 × 4 cubic yards = 20 cubic yards of earth per hour
4. The amount of material is measured in cubic yards. It will depend on the size of the bucket or blade.

Laboratory Activity (35)

The class period will be devoted to solving some problems of a construction contractor who has been hired to level a cow pasture for a highway site. Students may work the problems individually *or* in groups of 5, each taking a problem and combining their findings. It is suggested that students work individually.

1. Read the problem to the class and demonstrate the use of Fig. 33B-3 in the Laboratory Manual to find the area in acres of earth moved per hour.
2. Walk around the room and give help as needed.
3. Emphasize that the most efficient equipment is the one that moves the most earth for the least cost.
4. Select a few students to report their total cost. Have the students record the total cost for each problem.

Homework

Reading 34

Answers for Laboratory Manual

Fig. 62-1. Efficiency Chart

		I	II	III	IV	V	VI	VII
Equipment	Problem	Width of cut, in feet	Speed, in miles per hour	Area, in acres per hour	Number of hours	Equipment cost–hr	Total Cost	Most Efficient
Bulldozer: Minor leveling and excavation	1	4	7 Example	2.8	39	$20.00	$780	
	2	6	6	3.6	28	$20.00	$560	
	3	7	3	2.1	48	$20.00	$960	
	4	8	5	4.0	25	$20.00	$500	$500
	5	9	4	3.6	28	$20.00	$560	
Scraper: Major leveling and excavation	1	3	7	2.1	48	$30.00	$1440	
	2	4	6	2.4	42	$30.00	$1260	
	3	5	4	2.0	50	$30.00	$500	
	4	6	5	3.0	33	$30.00	$990	$990
	5	7	3	2.1	48	$30.00	$1440	
Truck: Excess earth transported from site					33	$10.00	$330	$330
Front-end loader: Loading of excess dirt into trucks					33	$15.00	$495	$495

Total Equipment Cost **$2315**

ASSIGNMENT 63, UNIT 34A

Handling Grievances

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to handling grievances:
   a. Describe the way (grievance procedure) you have of settling differences if you want to watch a particular television program, but your parents or brothers and sisters want to watch another.
   b. Describe what you think might happen on a construction project if orderly procedures for handling complaints were not agreed upon before they occur.

Discussion

2. Given Reading 34, the lecture on grievance procedures, and some discussion questions:
   a. Define "grievance."
   b. Explain the reason for workers' grievances.
   c. Explain the grievance procedures used to solve a worker's grievances.

Laboratory Activity

3. Given a role-playing situation concerning a labor-management grievance,
   a. Serve as a member of the grievance committee, and present the position for a satisfactory solution from the worker's viewpoint.
   b. Serve as a member of the grievance committee, and present the position for a satisfactory solution from management's viewpoint.
   c. Participate in a simulated collective bargaining session to work out a solution to a grievance problem.

Time Schedule

5 Overview
10 Lecture
5 Discussion
25 Laboratory Activity

Overview (5)

For the past two days we have discussed earthmoving and the part it plays in construction. Today we will talk about grievance procedures and the part they play in the construction industry.

1. You read about the kinds of problems covered by grievance procedures and why grievance procedures are needed. You also read about the proper grievance procedures to follow when a particular problem arises.
2. I will tell you about the procedure for handling grievances and what happens when the procedure fails.
3. You will be asked to tell why grievances occur and identify some points important to good grievance procedure.
4. In your laboratory activity, you will play a role in a collective bargaining session. Some of you will serve as members of a labor grievance committee and others will serve as members of a management grievance committee. All of you will try to work out a solution to a grievance problem.

Lecture (10)

Today's presentation concerns the handling of grievances by labor and management.

1. A "grievance" is a person's complaint about his job.
2. Grievances usually center on the worker's belief that he is not getting the praise, rewards, working conditions, or satisfaction which he deserves.
3. All grievances are handled through established grievance procedures. There are several reasons:
   a. They make it easy for people to talk to each other.
   b. They promote understanding of the way other people feel.
   c. They let the workers know that their employer will listen to their complaints.
4. Labor's role in the grievance procedure is to present the worker's problems and to work for a satisfactory solution. The role of management is to present its side of the problem and to work for a solution that would be satisfactory to management. In order for this to happen, each side has to be willing to allow the other

to talk and to listen to its position about the problem.

5. If there were no established grievance procedures, there would be discontent which would eventually affect worker-employer relationships.
6. The following are important to any good grievance procedure:
   a. There should always be representatives from both union and management.
   b. They should always begin with the lowest level of management, usually the foreman. Sometimes grievances can be worked out with the foreman.
   c. The discussion should move upward in order, from one level of authority to the next, until a satisfactory solution is found.
   d. Management, at all levels, should have the authority to settle the matter without going any further.
7. If the normal grievance procedure does not work, then mediation or arbitration must be used. In mediation, an outsider listens to the problem and then makes a decision which he has no power to enforce. In arbitration, an outsider listens to the problem and then makes a ruling which he has the power to enforce.

Discussion (5)

1. What does the term "grievance" mean? (A grievance is a complaint a person has about his job.)
2. What are the usual causes of grievances? (The person feels he is not getting the praise, rewards, working conditions, or satisfaction which he deserves.)
3. What are some of the things important to any good grievance procedure?
   a. Both labor and management should be present.
   b. It should begin at the lowest level.
   c. It should progress from one level of authority to the next until a satisfactory solution is found.
   d. Management, at all levels, should have the authority to settle the matter without going any further.

Laboratory Activity (25)

The students will act out labor and management roles to settle a grievance.

Directions

1. Divide the class in half. One half will represent management and the other half will represent labor. Students can choose their group *or* you can assign them to a group.
2. Assign one student to act as mediator and one to act as arbitrator in the event that an agreement cannot be reached *or* the teacher should be prepared to serve as mediator and arbitrator.
3. Have the students elect or you appoint two members in each group to act as spokesmen.
4. Read the "Grievance" and "Dispute" to the class as a whole. Point to the labor group when workers are referred to and point to the management group when J. M. Beck is referred to.
5. Have each committee review its position. Allow each committee about 10 minutes to talk over their case with their members. Suggest that the spokesmen write down the position from which they will start the discussion.
6. Seat all of the students in a circle or around a conference table (tables pushed together).
7. Have the spokesmen for each group present their position, labor first, then management. Encourage all members to offer suggestions for a solution.
8. Be prepared to ask leading questions to stimulate discussion such as, "What are you going to do to solve this grievance?" Questions will depend on how the committees go about solving the problem.
9. After both sides have had a chance to discuss the problem and if there is heated discussion, have both committees *switch roles* at high points of argument. Switch roles as often as it is effective. When you switch roles, repeat a few of the statements that have just taken place to acquaint students with their new point of view.
10. During the last 5 minutes, try to summarize the grievance outcome. Try to itemize who has agreed to what.

Suggestion:

You may want to tape the discussion, if the equipment is available, and play it back. This is a stimulant to the students. Also, the teacher could send notes to some of the members of the committee to spark them as suggested in the collective bargaining activity.

If no agreement has been reached you may want to continue the discussion in optional Activity 34.

Homework

None. Assignment 64 is optional. If the optional assignment is not used, assign Reading 35.

ASSIGNMENT 64, UNIT 34B (OPTIONAL)

Handling Grievances

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given a previous grievance situation:
   a. Examine and analyze problems from the previous activity.
   b. Review the procedures for the solution of a grievance.

Laboratory Activity

2. Given a grievance problem:
   a. Serve as a labor or management member of a grievance committee and present a position for a satisfactory solution of the problem.
   b. Participate in a simulated collective bargaining session.

Time Schedule

5 Overview
15 Lecture-Discussion
25 Laboratory Activity

Overview (5)

Yesterday's activities concerned the handling of labor and management grievances. Today you will either continue with Activity 34B if no agreement was reached *or* be faced with another grievance problem to give you a better understanding of how grievance procedures work.

1. Today you will be given a chance to ask questions about problems that came up in yesterday's laboratory activity.
2. We can then discuss some questions about your role in solving the labor grievance.
3. In your laboratory activity, you will either continue the grievance procedure *or* have another grievance meeting with different students playing roles to represent labor and management.
4. If time allows, we will discuss some of the solutions together as a class.

Lecture-Discussion (15)

Today's work is optional. The instructor may elect to continue the discussion about handling grievances, or he may have the students complete a previous laboratory activity. If the teacher elects to continue the discussion of how to handle grievances, then his presentation should concern pertinent problems that came up in the previous laboratory activity. This time should be used to ask questions or answer students' questions about their role in solving labor's grievance.

Laboratory Activity (25)

Laboratory Activity 34B concerns how to handle labor grievances.

1. The teacher will choose students to serve as representatives of labor and of management. (The students should not be the same ones who played roles in the previous activity.) Divide the class in two groups. Assign the labor problem to one group and management to the other.
2. The problem should be read to the students and explained.
3. The students should be given enough time to solve the problem. Seat the students around a "bargaining table" for discussion.
4. Suggestion: When students are discussing the grievance concerning the safe site, hand a note to labor saying, "John Doe has just been injured by an automobile while working on the highway site. He has been taken to the hospital and is in critical condition."
5. It is suggested that you have the students "switch roles" sometime during the negotiations.
6. The class as a whole should discuss the solution if time allows.

Homework

Reading 35

ASSIGNMENT 65, UNIT 35

Stabilizing Earth and Structures

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to stabilizing earth and structures:
   a. Describe what can be done to prevent the sides of excavations from caving in on workers.
   b. Tell what must be done to support an existing structure if earth is removed very close to its foundation.

Discussion

2. Given a lecture on the stabilizing of earth and structures:
   a. Explain why excavation sites are trimmed and shaped.
   b. State four techniques used for grading an excavation site.
   c. State three techniques used for stabilizing an earthen wall.
   d. Explain why an adjoining building is underpinned during excavation.

Laboratory Activity

3. Given a site box filled with 2" of moist sand, two concrete blocks, and wood underpinnings:
   a. Underpin a simulated structure during the excavation of an adjacent area.
   b. Indicate the practices of trimming and stabilizing that should be performed.

Time Schedule

5	Overview
10	Lecture
5	Discussion
25	Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1	overhead projector/screen

Supplies

1	Transparency 65-1, 65-2, 65-3, 65-4

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	container for water
1	2′ spirit level
2	spoons or equiv. for excavating

Supplies (Group of 5)

1	site box with sand
2	8″ x 8″ x 16″ concrete blocks
8	¾″ x 1¾″ x 2″ wood blocks

Overview (5)

1. In your reading you learned some reasons for trimming and shaping the bed and walls of an excavation. You also learned about some of the practices used in stabilizing the excavation and the site.
2. I will tell you about some of the practices in more detail.
3. You will be asked to tell how earth and structures are stabilized.
4. In your laboratory activity you will carry out the process of underpinning a simulated structure.

Lecture (10)

1. Excavation beds and walls must be made solid so that they will hold their form and not collapse. Stabilizing begins with the trimming and shaping of the excavated site. This helps prepare the site for a foundation.
2. Trimming and shaping involve four kinds of practices: grading, sloping, cleaning and washing, and treating.
3. Grading means making the bed and walls of the excavation level and firm by cutting away high parts and filling in uneven, low spots. Four techniques may be used:
    a. Compaction is the packing down of earth to make it firm.
    b. Scaling means chipping or peeling away large pieces of soil from the excavation area.
    c. Filling means building up low points in the excavation bed or walls.
    d. Grouting means filling in earth or rock cavities with mortar.
4. Cleaning and washing means cleaning the mud from rock surfaces with a high-pressure hose.
5. Sloping means making the excavation walls into an incline to reduce the chances of the earth sliding into the excavation area.
6. Treating means to add a substance to the excavation walls to make them more solid. Freezing chemicals and concrete type materials are injected into the excavation walls to make them solid.
7. To protect workmen and structures, several practices of stabilizing may be necessary. The major practices include underpinning, piling, sheathing, bracing and shoring, compacting, and cofferdamming.
8. Show Transparency 65-1, Stabilizing Existing Structures. Often a contractor is called upon to excavate a site near an existing building. Both during the excavating and afterward, he must be concerned with stabilizing the building so that it does not tilt and collapse into the excavation site. The contractor will use *underpinning* to remove the danger of the building's collapsing. The earth will be excavated in sections and the building underpinned with concrete, a section at a time.
9. Show Transparency 65-2, Piling. Piling is used to improve the load bearing capacity of the earth and to help guard against uneven settlement of the structure. Friction piles support a load because of friction between the surface of the pile and the soil through which it is driven. The friction keeps the piles from moving. End piles or point piles support the load because the lower end of each pile rests directly on solid rock.
10. Show Transparency 65-3, Sheathing and Cofferdamming. Sheathing involves building walls to keep the earth out of an excavated area. Metal or wood panels are put in horizontally or vertically. Cofferdamming is a special sheathing used where water is likely to run into the excavated area. Cofferdamming keeps the working area dry. It is often used where concrete must be placed and cured.
11. Show Transparency 65-4, Bracing and Shoring. Bracing and shoring are used in combination with sheathing. Bracing runs horizontally across the excavation, between sheathing panels on opposite

sides. Sheathing is placed diagonally against a sheathing panel. Bracing is used for narrow excavations. Shoring is used for wide excavations.

12. Compacting means "making compact." Earth is compacted to make it more stable and firm, usually with large rollers or air hammers.

Discussion (5)

1. Why do we perform the trimming and shaping operations on an excavated site? (To give the excavation the correct shape and prepare it for the foundation.)
2. What four techniques are used for grading the excavation bed and walls? (Compacting, scaling, filling, and grouting.)
3. Why do we stabilize excavations and surrounding earth? (To protect workmen and structures.)
4. How are earthen walls stabilized? (Compacting, sheathing, bracing, shoring, and cofferdamming.)
5. What is underpinning? (The stabilizing of an existing building near the excavation site to keep it from tilting and collapsing into the excavation.)

Laboratory Activity (25)

Students will use the site boxes and concrete blocks to simulate the process of underpinning a structure.

1. Students will work in their groups of five. Have the foreman of each group assign tasks.
2. Explain that the activity involves stabilizing two concrete blocks which represent existing buildings standing adjacent to a vacant construction site. The students will excavate the site and stabilize the adjacent building next to it.
3. The sand must be prepared by adding water to it to give it body, so that it will support the blocks during the excavating and underpinning activities. Caution students against getting the sand too moist.
4. It may be necessary to add more sand to the site boxes.
5. *Demonstrate how to level the blocks.*
6. Remind students that useless, unsafe material should not be left lying around a construction site. Unless the material is removed, it would be considered an unsafe working condition and a safety hazard.

Homework

Review of Readings 29 to 35 is optional. If it is used, remind students to bring in the textbook for review. If it is not used, there is no homework.

Answers for Laboratory Manual

1. Sloping or facing and shoring.
2. Underpinning.
3. Answer will vary.

ASSIGNMENT 66, UNITS 29-35 (OPTIONAL)

Classifying Structures

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

Given the summaries of Readings 29-35, ask and answer questions about construction production technology, getting ready to build, clearing, locating the structures, earthmoving, handling grievances, and stabilizing earth and structures.

Time Schedule

45 Discussion or Laboratory Activity

Discussion or Laboratory Activity (45)

This review time can be used in various ways. Plan to do one of the following alternatives.

Alternatives

1. Students can play the "Big Builder" game to become more familiar with the concepts and processes of construction.
2. Pose the questions and situations at the end of each reading to stimulate thinking and discussion.
3. Have each group of students get together and list two or three words or concepts they would like to have explained or discussed. Discuss and clarify the concepts.
4. Ask a guest speaker, knowledgeable about clearing and earthmoving to talk to the class. Schedule the speaker for the first class period and tape record his talk so it can be played to your other classes.
5. Schedule a field trip to a construction site being cleared or excavated.

Note

Look ahead to Assignment 79 for instructions on building a jenny winch boom.

Homework

None

ASSIGNMENT 67

Test No. 4

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given IACP Construction Test No. 4, select responses from a list of items related to concepts presented in Readings 29 to 35.

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

1. Seat the students to best advantage for administering a test.
2. Distribute pencils, erasers, and eraser shields.
3. Distribute answer sheets and have students fill out needed information.
4. Pass out test booklets. "Keep closed until I say begin."
5. Read directions for filling in answers. Open test booklets and begin.
6. Allow 35 minutes for completion, then collect answer sheets, then test booklets.
7. Review the test with students to provide feedback.

Homework

Reading 36

Answers for Test No. 4

1. C　2. D　3. D　4. B　5. A　6. A　7. B　8. A　9. D

10. C　11. D　12. D　13. C　14. B　15. B　16. C　17. B　18. C

19. D　20. D　21. B　22. B　23. B　24. A　25. C　26. A　27. B

28. C　29. C　30. A　31. D　32. B　33. A　34. C　35. B

ASSIGNMENT 68, UNIT 36

Classifying Structures

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to types of structures:
   a. Name two structures that may not have substructures.
   b. List three superstructures and identify one as mass, one as bearing wall, and one as framed superstructure.

Discussion

2. Given Transparencies 68-2, 68-3, and a lecture on identifying substructure and superstructure:
   a. Identify different kinds of superstructures.
   b. Identify different kinds of roof supports.
   c. Identify different kinds of materials used in construction.

Laboratory Activity

3. Given some suggestions about building structures:
   a. Select and sketch a structure.
   b. Identify the substructure and superstructure.
   c. Determine the construction processes of the sketched project.

Time Schedule

5 Overview
5 Lecture
10 Discussion
25 Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1 overhead projector/screen

Supplies

1 set Transparencies 68-1, 68-2, 68-3

Equipment and Supplies for Laboratory Activity

Supplies (Each student)

2 sht. 8½" x 11" white paper
1 pencil/eraser

Overview (5)

In the last two weeks you have studied production technology, getting ready to build, clearing the site, locating the structure, earthmoving, the handling of grievances, and the stabilizing of soil and structures. These topics pertained to preparing a site to receive a structure. Now you are going to learn about structures and how they are built. You will learn how to identify or classify structures, and you will study how structures are built by following a common construction process.

1. In your reading, you learned that structures are made up of a substructure and a superstructure.
2. In my lecture, I will explain how to identify substructures and superstructures.
3. You will see some transparencies, and we will discuss how structural elements are used.
4. In your laboratory activity, you will select a structure and sketch it, showing the substructure and superstructure. Then you will try to identify steps in the construction process for your structure.

Lecture (5)

Today's lecture will explain how to identify substructures and superstructures.

1. Basically, any constructed work may be called a *structure*.
2. Every structure has two parts. Its substructure rests on some part of the earth which is called the "bearing surface." Its superstructure rests on the substructure.
3. Show Transparency 68-1, Classifying Structures. Discuss the items under the major classifications of "substructures" and "structures."
4. The rest of today's presentation will concern superstructures. Substructures will be discussed in more detail in the next presentation.
5. The superstructure is the part of the building structure above the ground level.
6. There are three general kinds of superstructures.

a. A mass superstructure is one that uses a solid mass of material (e.g., a dam or highway).
b. A bearing wall superstructure is one that uses unframed walls to serve as the main roof support and enclose a space (e.g., brick home, concrete block supermarket).
c. A framed superstructure is one that uses columns and beams extensively. This kind of construction is highly developed and allows an economical use of materials (e.g., skyscrapers).

Discussion (10)

1. Show Transparencies 68-2 and 68-3. Identify These Structures. As each structure is shown, point out how the structural elements are used: e.g., columns in an Egyptian temple.
2. The following questions may be asked about these structures.
   a. What kind of superstructure is used?
   b. What kind of roof support is used?
   c. What kinds of materials might be used in the construction of this structure?
3. The rest of the discussion will pertain to the transparencies. The structures to be shown and discussed are listed here.
   a. Simple adobe (mud) hut with a flat roof. (Bearing wall superstructure, no substructure.)
   b. Old house built in Elizabethan times showing use of beams in roof construction. (Framed superstructure, spread substructure.)
   c. Greek temple (Parthenon) showing use of columns. (Bearing wall superstructure, spread substructure)
   d. A dam (Hoover Dam, for instance) is an example of mass construction. (Mass superstructure, spread substructure)
   e. A solid brick home. (Bearing wall superstructure, spread substructure)
   f. A skyscraper. (Framed superstructure, spread or piled substructure)
   g. A bridge. (Framed superstructure with mass road, piled or mass substructure)
   h. A highway. (Massed superstructure, floating substructure)
   i. A sheet metal tank. (Bearing wall superstructure for the top which holds water or gas, spread or piled substructure)

Laboratory Activity (25)

1. Have each student select one of the structures suggested in the Laboratory Manual for sketching on any plain paper. Show Transparency 68-2 and 68-3 to give students some ideas on what to sketch.
2. Instruct students to include and identify the substructure and superstructure.
3. Have students check the steps in the construction process that they think might have applied to the project that they are sketching.
4. During the last 10 minutes, have a few students hold up their sketches, identify the substructure and superstructure and indicate what steps in the construction process apply. (All steps should apply to all structures.)

Homework

Reading 37

Note

See Assignment 69 to prepare model foundation walls and footings prior to class.

ASSIGNMENT 69, UNIT 37

Setting Foundations

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to setting foundations:
   a. Name the type of footing under your home, your school, and the nearest bridge. Compare and contrast their differences.
   b. Tell why the Tower of Piza in Italy leaned about 14 feet and describe what can be done to stop it from leaning any farther.

Discussion

2. Given the demonstration, text reading, and some questions:
   a. State the reasons for using a foundation.
   b. Identify which foundation element is used to distribute the weight of the structure over the soil.
   c. Identify the common material used to construct most foundations.

Laboratory Activity

3. Given a simulated substructure and load:
   a. Determine what happens when a load is applied with and without a spread footing.
   b. Determine what happens to the bearing surface when a load is applied to a floating footing.

Time Schedule

5	Overview
15	Demonstration
5	Discussion
20	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	claw hammer

Supplies

1	$\frac{3}{4}''$ x 6″ x 12″ board
1	sponge (approx. 2″ x 6″ x 10″)
1	brick
4	8d common nails

Note: It is suggested that you make a mock up of a piled cap footing, a spread footing, and a floating footing for display purposes.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	claw hammer

Supplies (Group of 5)

1	site box tray with sand
1 pc.	2″ x 16″ sheet metal*
4 pcs.	$\frac{3}{4}''$ x 1″ x 4″ wood*
1 pc.	$\frac{3}{8}''$ x 5″ x 5″ plywood
1	brick
4	6d box nails

*Note: Teacher makes prior to class. See Fig. 69-1, 69-2.

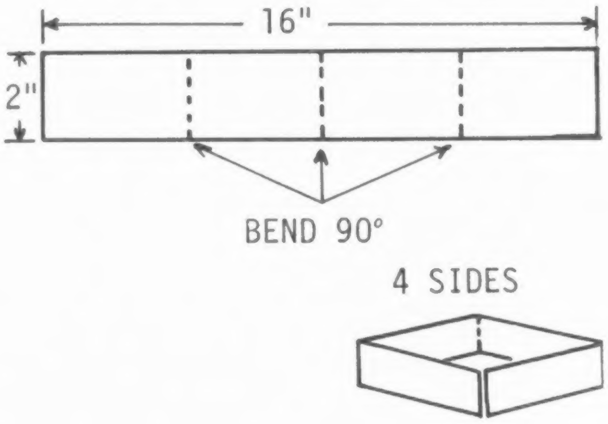


Fig. 69-1. Foundation Walls

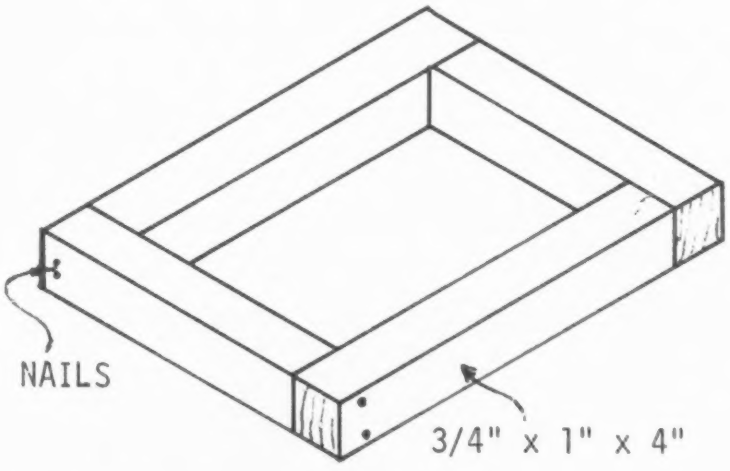


Fig. 69-2. Spread Footing

Overview (5)

Yesterday you learned how to classify structures.

1. Your reading gave the reason for building foundations, the elements that make up foundations, some types of footings, different kinds of materials used for footings, and the way to set a foundation.
2. I will demonstrate why and how a pile cap foundation is used.
3. In the discussion you will be asked to explain why structures need foundations, why footings are needed, and how weight and load of a structure are distributed over the soil.
4. In your laboratory activity you will determine the effects of using spread footings and floating footings.

Demonstration (15)

Today I will demonstrate the use of piled foundations.

1. Before beginning the demonstration, review the following points from the reading.
   a. The foundation of a structure is the part that supports the weight of the whole building; it transfers that weight, plus its own weight, to the ground on which it rests.
   b. The foundation or substructure can be divided into three parts:
      1) The part of the earth on which the foundation rests is called the "bearing surface."
      2) The flat part of the foundation which spreads the load of the structure onto the bearing surface is called the *footing*.
      3) The upright supports, such as the walls or piers, rise above the footing to form the rest of the substructure.
   c. There are three basic kinds of footings.
      1) Spread footings are used on bearing surfaces of rock or soil that is packed solidly: for example, hard clay.
      2) Floating or raft footings are used where the soil of the bearing surface is soft or where there might be vibration from an earthquake.
      3) Pile cap footings are used if the bearing surface is covered by water; for example, the bed of a river or lake. They are also used along the ocean, on marshy land, and on sand.
2. Explain that you are now going to demonstrate why a pile cap foundation is used.
3. Put a soft, dampened sponge in the approximate center of the board. See Fig. 69-3.
4. The board represents good bearing soil at great depth. The sponge represents an upper soil layer which is very soft or marshy; it does not present good bearing conditions for a structure.
5. With this in mind, I'll place the brick, which represents the weight of the structure, on the sponge (soil). Observe what happens. See Fig. 69-4.
6. Because the soil does not present a good bearing surface, the brick settles unevenly: it sinks into the sponge, tilts, and falls. Remove the brick.

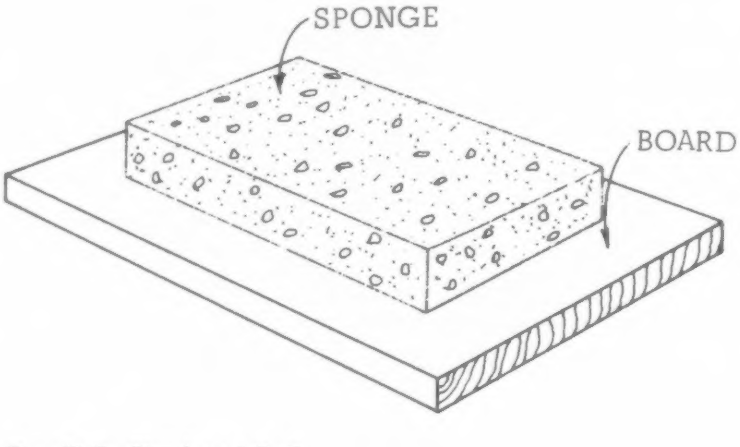


Fig. 69-3. Simulated Soil

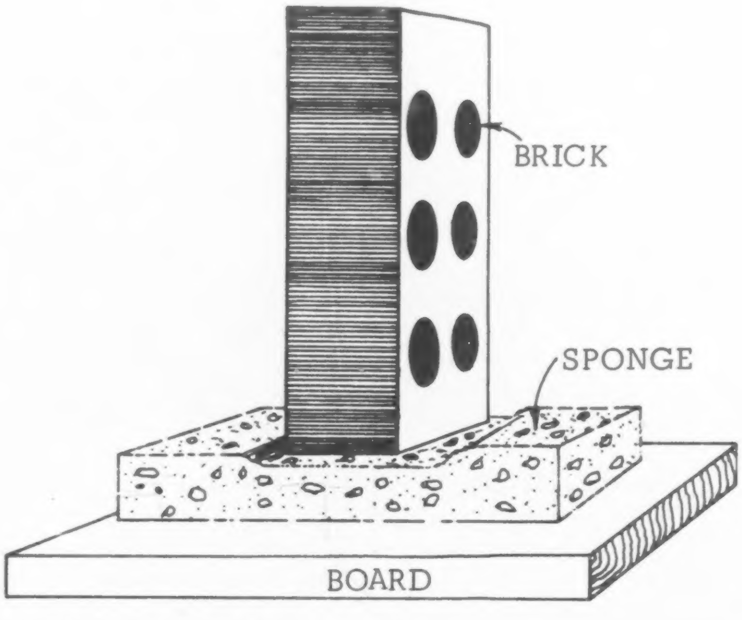


Fig. 69-4. Simulated Weight on Soil

7. This problem can be corrected as follows:
    a. Nails, representing capped piles, should be driven down until good support is found. They should be spaced as evenly as possible and driven through the sponge down into the board.
    b. The nails should be driven until their caps (heads) are just under the top of the sponge.
    c. Now that the piles are driven, the brick may be placed on them at ground level. (See Fig. 69-5.)
8. There is no settling because the weight of the structure is supported by the pile cap. Keep in mind that a pile cap may be used to overcome poor soil conditions.

Discussion (5)

1. Why do all structures need a foundation? (A foundation helps distribute the weight of the structure, so that it will not sink into the soil.)
2. Would it make any difference in the needs of a foundation whether the foundation walls were block, steel, or concrete? (No.)
3. How does a footing under a building affect settling? (If it has a footing, the building will settle evenly. The Leaning Tower of Pisa is a good example of how a structure may look if it has no footing or a poor footing.)
4. What foundation element distributes the weight and load of the structure over the soil? (The footing, the flat part of the foundation.)
5. What common material is used to construct most foundations? (Concrete.)

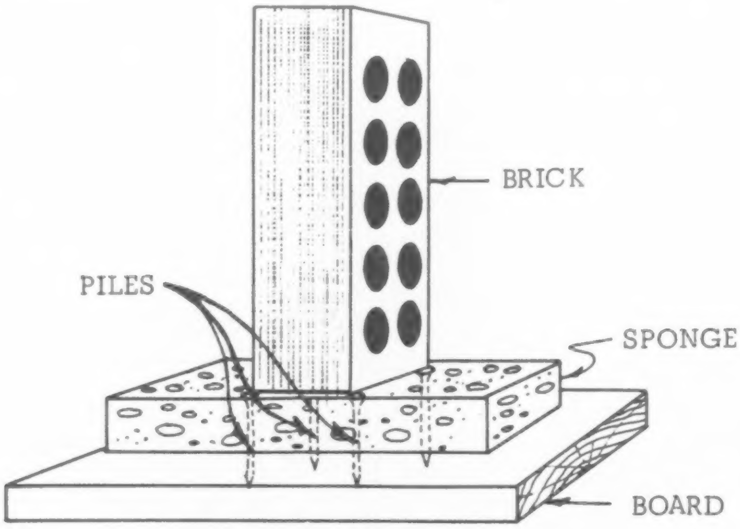


Fig. 69-5. Simulated Pile-Cap Foundation

Laboratory Activity (20)

In today's activity the students will work in groups of five to determine the effects of using spread and floating footings.

1. Explain the activity directions to students, as necessary.
2. Students should divide the operations among group members, with the foreman's guidance.
3. Walk around the class observing the students and answering questions.

Homework

Reading 38

Answers for Laboratory Manual

Questions

1. The walls did not sink into the sand.
2. To spread the weight of the superstructure.
3. Spread footing.
4. A spread footing rests on a bearing surface, a pile cap footing is driven in and is under the bearing surface.
5. Spread footing.
6. Foundation wall.

Problem 2

1. The bearing surface is compressed or compacted.

Questions

1. The foundation didn't sink at all. The weight was spread. It "floated".
2. To spread the weight of the superstructure.
3. Floating footing.
4. The floating footing covers a large area on the bearing surface. The pile cap footing is under the bearing surface.
5. Floating footing.
6. Foundation wall.
7. There was little compaction or compression.

ASSIGNMENT 70-71, UNITS 38A AND B

Building Forms

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to building forms:
   a. Identify at least two concrete surfaces that were shaped against forms and tell if these were foundation forms or forms for the superstructure.

Laboratory Activity

2. Given the necessary equipment, supplies, and drawings for a footing form and column form, lay out, mark, saw, and assemble the parts.

Time Schedule, 70

5 Overview
20 Demonstration
20 Laboratory Activity

Time Schedule, 71

45 Laboratory Activity

Equipment and Supplies for Demonstration

The instructor will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow. He also will need:

Supplies

1	scrap piece of 2″ x 4″ lumber
1	small scrap of wood to aid in drawing nails

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	tape *or* folding rule
1	try square
1	claw hammer
1	pencil
1	crosscut saw
1	ripsaw
5	nail aprons (dye in colors for foreman)

Supplies (Group of 5)*

Footing Form

1 pc.	¾″ x 3″ x 51″ wood (form sides)
1 pc.	½″ x 15½″ x 48″ ply (base)
1 pc.	16″ x 48″ 15 lb. building felt
20	6d common *or* box nails
4 pcs.	¾″ x 1″ x 3″ wood cleats

Column Form

1 pc.	¾″ x 5½″ x 48″ wood (form sides)
1 pc.	¾″ x 2″ x 28″ wood (braces)
2 doz.	6d common *or* box nails

*Note: Do not precut stock materials. Actual measurements are given for your information.

Overview (5)

Yesterday you learned that the first stage of building a structure is to set the foundation, and the first step in making footings is to build the forms. For the next two days, you will learn how to build forms.

1. In your reading you learned about molding concrete, the various kinds of materials used in making forms, identifying the form parts, and some practices of building forms.
2. I will demonstrate some procedures that you will need to know before you build your forms. First, I will demonstrate how to measure and mark a board. Next, I will show you how to saw a board correctly and tell you about some differences in saws. Finally I will show you how to nail properly.
3. In your laboratory activity, you will lay out, mark, saw, and assemble parts according to plans to build forms. You will have three days to complete this activity.

Demonstration (20)

Today's demonstration concerns the use of a try square, claw hammer, crosscut saw, and ripsaw.

1. Before class, arrange the necessary equipment and supplies on the workbench.
2. Group students so all can see the demonstration.
3. Demonstrate how to lay out and mark a piece of wood. Explain that each group will use these same procedures to build wood forms.
4. Place a ¾″ x 3″ x 56″ board in front of

you on the workbench. Hook the end of the tape measure over one end of the board and extend the tape along the board.

5. Make a clear pencil mark at 12¾″, 25½″, 38¼″, and 51″.
6. Now place the try square against the edge of the board and draw a line across the board at each mark. Be sure that students observe how to position the try square.
7. Place the board on a sawhorse or in a woodworking vise so that the lines may be easily seen. Caution students that the mark should project past the edge of the bench to prevent sawing into the bench.
8. Show how to place the crosscut saw on the line perpendicular and at a 45° angle to the wood.
9. Show how to make a small starting cut in the wood by drawing back lightly with the saw.
10. Show how pushing forward lightly removes material; the saw cuts on the forward stroke.
11. Caution that once the saw starts cutting, the thumb knuckle should be removed from the line.
12. Using about the center ⅔ of the blade with each stroke, continue sawing.
13. Explain that as you near the completion of the cut, you must ease off on the pressure to avoid splintering. Saw off all four pieces.
14. Let all the students see that the teeth of a crosscut saw are shaped like a knife, while the ripsaw has chisel-shaped teeth.
15. Remind your students that the crosscut saw is used to cut across the grain, and the ripsaw is used to cut with the grain.
16. Demonstrate how to lay out, mark, and saw a 15½″ x 48″ piece from a sheet of ½″ x 4′ x 8′ plywood.
17. Explain the coarseness of a saw: it is measured as the number of points per inch. A coarseness number is found on the heel of the saw.
18. Point out the handle, blade, heel, toe, and length of a saw.
19. Demonstrate how to cut the 15 lb. building felt.
20. Demonstrate how to hold a hammer properly.
21. Show how to drive nails correctly for face nailing. Face-nail the form facings together. See Fig. 38-1 in the Laboratory Manual.
22. With a block of wood under the hammer head, demonstrate how to draw nails.

Laboratory Activity (20)

1. Indicate that the purpose of this activity is to help the students understand the procedures of laying out, marking, sawing, and assembling the parts to make a form. The students have two days to complete their forms. Allow them to saw the 15½″ x 48″ piece from a 4′ x 8′ sheet. The 15½″ x 48″ sheet will be used as subflooring in Activity 47C. Cover the 15½″ x 48″ bases with building paper or plastic to protect the surface from concrete.
2. Group A (three students) will make a footing form. Group B (two students) will make the footing base. Note: only 5 column forms (1 spare) need to be made for erecting the steel. All other students can make foundation forms (stepping stones) or any other form you may want to make. About 20 foundation slabs need to be made to lay block on.
3. Have one student from each group obtain the necessary materials and place them in the work area. Have another student from each group obtain the necessary tools and place them in the work area.
4. Walk around the class, observing the students and answering questions.
5. The last few minutes of the laboratory period should be spent in storing the equipment and supplies and sweeping the sawdust from the floor.

Safety Precautions

1. When starting a saw cut, guide the blade with your thumb knuckle. Keep your fingers away from the cutting edges.
2. Start a saw cut with a backward stroke.
3. To start a nail, tap it lightly, remove your hand, then complete the nailing.
4. If you injure yourself, report to the teacher for First Aid treatment.

Homework

None for Activity 38B. Assign Reading 39 on Assignment 71.

ASSIGNMENT 72, UNIT 39

Setting Reinforcement

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to setting reinforcement:
   a. Give reasons why you think reinforcing steel rods are deformed (ridges on the surfaces of the rods) and consider why smooth surfaced reinforcing steel would not work as well.
   b. Look up "tensile" or "tensile strength" in the dictionary, then determine whether or not reinforcing steel in concrete will allow a solid concrete mass to "bend".

Laboratory Activity

2. Given a footing and column form requiring the setting of reinforcement, measure, mark, cut, bend, seat, and tie reinforcing steel in the form.

Time Schedule

5	Overview
15	Lecture-Demonstration
25	Laboratory Activity

Equipment and Supplies for Lecture-Demonstration

The instructor will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment (Group of 5)

2 pr.	side cutter pliers
1	12" rule
1	pencil
1	claw hammer
1	5/8" twist drill *or* speed bit
1	1/4" electric drill
1	hacksaw
1	cold chisel

Supplies (Group of 5)

Footing

1 pc.	3/8" x 60" steel reinforcement rod
4 pcs.	10" lengths of coat hanger wire
1 pc.	36" length, 16 gauge black iron wire
1 qt.	30 W motor oil (per class)
	rags

Column

1 pc.	3/8" x 36" steel reinforcement rod
1 pc.	16" length, 16 gauge black iron wire
2 pcs.	3/4" x 3/4" x 4 3/4" wood
2	8d common nails

Overview (5)

During the past two days you were involved in building forms. Today you will learn how to set reinforcement in your forms.

1. You read about the various kinds of reinforcing steel and about how reinforcing steel is prepared and placed.
2. I will explain how reinforcement bars and mesh are used in construction.
3. In your laboratory activity, you will lay out, cut, bend, seat, and tie reinforcing steel in a form.

Lecture-Demonstration (15)

1. After forms are assembled, reinforcing steel is set in place to give the concrete added strength.
2. The two basic kinds of reinforcing steel are rods and mesh.
3. Reinforcing steel rods are round with a pattern of ridges pressed into the surface.
4. These bars are said to be "deformed" because their surface is not smooth. The ridges prevent the bars from being pulled out of the concrete.
5. The numbering system for sizing rod is based on the diameter of the rod. No. 1 rod has a 1/8" diameter, No. 2 rod has a 1/4" diameter, and so on. We will be using No. 3 rod, 3/8" diameter.
6. Another type of reinforcing material is steel mesh. This looks like a wire fence. It is used in slabs.
7. Before reinforcing rods are used on the site, they are cut and shaped. At steel fabrication plants all rods are cut to length, shaped, and bundled. This is done from shop drawings. The bundles are then shipped to the construction site.
8. Reinforcing rods are erected or put into place according to blueprints. They are

tied together with wire. In slab work, rod and mesh are held above the surface by high chairs.

Demonstration

1. Show students how to make and use the bending jig to make high chairs. See Fig. 39-3 in the Laboratory Manual.
2. Show students how to cut and tie reinforcement bar. See Fig. 39-4 in the Laboratory Manual.

Laboratory Activity (25)

Today the students will measure, cut, and tie reinforcing rods, make high chairs, and place them in forms. They will then treat the forms.

1. Have students assemble in groups of five and get their equipment and supplies.
2. Have three students per group make the reinforcement rod while the other two make high chairs. Note: Check your steel angle iron base plates for the steel column to see if the distance between the anchor bolt holes is 2¾". If the distance is not 2¾", adjust the measurement on the spacer block to match the anchor holes. See Fig. 39-8 in the Laboratory Manual.

Safety Precautions

1. Always be careful when working with wire so that the ends do not strike anyone in the face or eyes.
2. Be sure to hold the end of the wire when cutting it.

Homework

Reading 40

ASSIGNMENT 73, UNIT 40

Mixing Concrete

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to mixing concrete,
   a. Figure what length of sidewalk can be made from one cubic yard of concrete (3′ x 3′ x 3′) if the sidewalk is to be 4 inches thick and 3 feet wide.
   b. Give two reasons why sidewalks or driveways of concrete may have small holes on their surfaces.
   c. List how many "ready mix" concrete mixing plants are located in your community.

Discussion

2. Given a demonstration on mixing and placing concrete:
   a. State the proportions for a concrete mix.
   b. Tell what a slump test is and why it is important.
   c. Name the steps involved in mixing and placing concrete in a footing and column form.

Time Schedule

5	Overview
30	Lecture-Demonstration
10	Discussion

Equipment and Supplies for Demonstration

Equipment

1	mortar box (for mixing concrete)
1	steel cement finishing trowel
1 qt.	measure
1	wheelbarrow
1	plastic measuring cup
1	wood float
1	hoe *or* shovel
1	bucket (for washing tools)
1	slump test mold (16 oz. paper cup)
1	hammer
1	5/8″ x 24″ bullet-pointed steel rod *or* equivalent

Supplies

1	footing form 3″ x 12″ x 12″
1	¾″ x 6″ x 6″ spacer block drilled with 9/16″ holes
1	column form 4¾″ x 4¾″ x 12″
6	8d common *or* box nails
1	screed 1″ x 3″ x 18″ wood
2	½″ x 6″ square head bolts/nuts/washers
1	large plastic sheet *or* building felt

Footing mix (3″ x 12″ x 12″)

Prop.	**Measure**
1	2 cups (1 pt.) water
2	4 cups (1 qt.) cement
6	12 cups (3 qt.) sand (fine aggregate)
8	16 cups (4 qt.) gravel (course aggregate)

Column mix (5″ x 5″ x 12″)

Prop.	**Measure**
1	1½ cups water
2	3 cups (¾ qt.) cement
6	9 cups (2¼ qt.) sand (fine aggregate)
8	12 cups (3 qt.) gravel (course aggregate)

Overview (5)

Yesterday the class tied together reinforcing steel and supported it with high chairs. The forms were then treated with oil to prevent concrete from sticking to the form.

1. You have read about the preparation of course and fine aggregate, the preparation of cement, the use of admixtures, and measuring and mixing concrete.
2. Today I will demonstrate how to proportion, mix, test, place, rod, screed, and finish concrete for a footing. I will also demonstrate how to set a column form, place concrete in it, and set anchor bolts.
3. Tomorrow you will be mixing and placing concrete, so watch carefully.
4. After the demonstration you will be asked to (a) state the proportions in a concrete mix, (b) tell me what a slump test is and why it is important, and (c) name the steps involved in mixing and placing concrete in a footing and column form.

Lecture-Demonstration (30)

This demonstration will show how to proportion, mix, test, place, rod, screed, and finish concrete in a footing form and column form.

1. Before class, arrange the necessary equipment and supplies.
2. Indicate that the 1 quart can and the measuring cup are the measuring devices for the laboratory work to follow. Use the can and cup to proportion ingredients into the wheelbarrow or mortar box.
3. Concrete is proportioned according to a formula much the same as your mother would measure out various ingredients for a cake or pie. Our proportions for concrete will be 2:6:8. This means there are 2 parts cement, 6 parts fine aggregate (sand) and 8 parts coarse aggregate (gravel).
4. The amount of water is not given. It is not given because the moisture in the sand would affect the water content of the mix. The sand might be wet, moist, or dry. We need to determine how much water is needed. To do this we make what is called a "slump test." I will demonstrate a slump test in a few minutes.
5. In mixing concrete, you first proportion out the ingredients. But how much do we need? To determine how much concrete we need, we have to know the volume (space inside the form). Your form is 3″ x 12″ x 12″. By multiplying the thickness by the width by the length we can find the volume: 3″ x 12″ x 12″ = 432 cubic inches.
6. Engineers have figured out that to change cubic inches into gallons you can multiply by .004. So 432 × .004 = 1.728 gal. or rounded off, 1.75 or 1¾ gallons. You will be using a 1 quart and a 1 cup measure. How many quarts are there in a gallon? (4) How many cups in a quart? (4) We need a total of 7 quarts or 28 cups. We will add 1 qt. surplus for spillage and the concrete left in the mortar box. Thus, we will have a total of 8 quarts or 32 cups of concrete.
7. In our batch we have the proportions of 2:6:8. This proportions to about 4 cups (1 qt.) of cement, 12 cups (3 qt.) sand,

and 16 cups (4 qt.) gravel. (Mark these figures on the chalkboard.)

Mixing for the Footing

8. We are now ready to mix. Have one or two students (or yourself) proportion out the batch. Place the ingredients in one end of the mortar box or wheelbarrow. Dry mix the batch until all ingredients are thoroughly mixed.
9. Add water, 1 cup at a time. (It should take about 2 cups.) Count the number of cups of water necessary to give the correct consistency to the concrete. (Note: Concrete must contain a minimum amount of water to permit application of surface finishes.) Thoroughly mix the concrete.
10. Show the slump test mold (also called slump cone).
11. Demonstrate how a slump test is made:
    a. Dampen the mold and place it on a flat surface.
    b. Hold the mold down securely.
    c. Fill the mold to ⅓ of its capacity.
    d. Rod 25 times with the bullet-pointed steel rod.
    e. Finish filling the cone in two more layers, ⅓ each time.
    f. Rod each layer 25 times. Each stroke should penetrate into the underlying layer.
    g. Strike off by screeding.
    h. Do not vibrate or tap the side of the mold to compact the concrete.
    i. Invert the mold and remove it by gently raising it vertically.
    j. After removing the mold, measure the slump as follows:
        1) Place the cone (test mold) beside the concrete specimen.
        2) Measure the distance between the top of the cone and the center of the top of the concrete specimen. See Fig. 73-1.
        3) The slump should not be more than ⅓ the cone height.

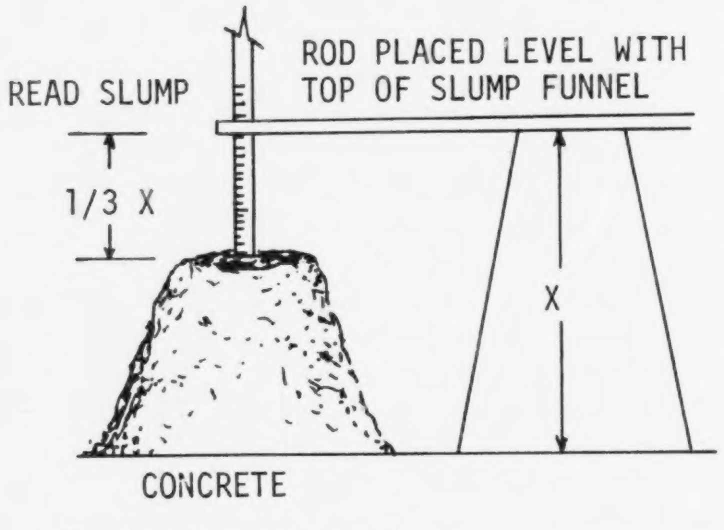


Fig. 73-1. Slump Cone Test

12. Next, demonstrate placing and finishing concrete by placing, rodding, screeding, and finishing concrete in the form. Work the concrete around the reinforcement rod.
13. Using a hand float, demonstrate how a rough finish is applied to the concrete.
14. Using a steel trowel, demonstrate how a smooth finish is applied to the concrete.

Setting Column Form

15. Place the column form in place over the reinforcement. Nail the braces to the form facings.
16. Have two boys mix up a batch of concrete for the column. Batch 3½ cups water, 7 cups (1¾ qt.) cement, 21 cups (5¼ qt.) sand, and 28 cups (7 qt.) gravel. Point out what they are doing right or wrong.
17. While they are mixing, place the ½"

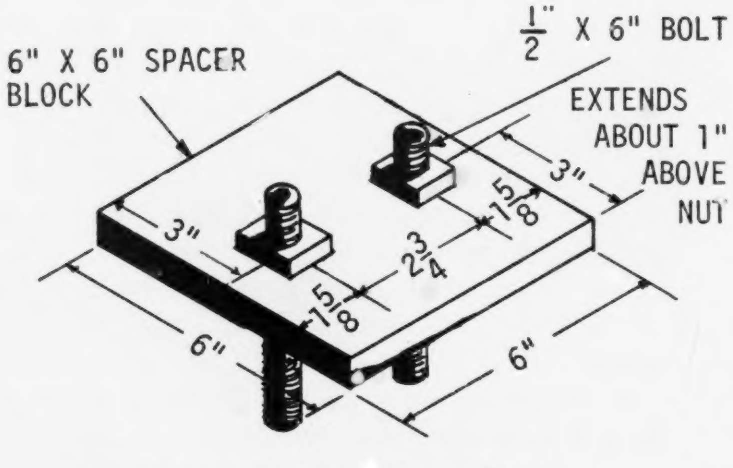


Fig. 73-2. Anchor Bolts in Spacer Block

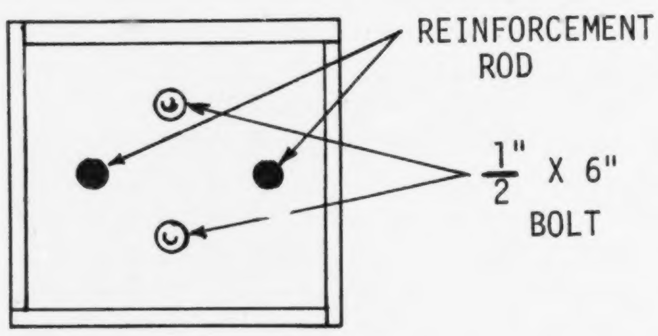


Fig. 73-3. Anchor Bolt Placement

anchor bolts in the spacer block. See Fig. 73-2. Notice the position of the reinforcement rod.

18. Place the column mix in the form and rod thoroughly.
19. Place the anchor bolts at right angles to the reinforcement rod. See Fig. 73-3. Nail the spacer block in place with 2 nails. Leave the nail heads above the block for easy removal.
20. Demonstrate how to clean the equipment. Emphasize the need to clean tools and equipment immediately after use.

Discussion (10)

1. What will be the proportions of the concrete mix you will use tomorrow for your footing form? (2:6:8) What are these proportions in cups? (2 cups water), 4 cups (1 qt.) cement, 12 cups (3 qt.) fine aggregate (sand), and 16 cups (4 qt.) coarse aggregate (gravel).
2. What is a slump test? (A concrete wet mix test to determine the correct proportion of water to add to the mix.) Why is a slump test important? (Too much water or too little water will weaken the mix and also make it difficult to work.)
3. What are the steps you would go through, from start to finish, for a concrete job?
   a. Determine mix proportions
   b. Figure volume
   c. Proportion out ingredients
   d. Dry mix
   e. Add water, wet mix
   f. Slump test
   g. Place concrete
   h. Rod concrete
   i. Screed concrete
   j. Trowel finish

Homework

Reading 41

ASSIGNMENT 74, UNIT 41

Placing and Finishing Concrete

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to placing and finishing concrete:
   a. Identify at least one steel trowel finish, one float finish, and one broom finish on concrete surfaces around your home or school.
   b. Describe how weather affects concrete finishing.

Laboratory Activity

2. Given the necessary equipment and supplies and a footing form set with reinforcement steel, proportion, mix, test, place, rod, screed, and finish concrete to make a concrete footing.

Time Schedule

5	Overview
5	Lecture-Discussion
35	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	pr.	pliers, slipjoint
1		12" rule
1		claw hammer
1		20 gal. bucket
1		wheelbarrow
1		plastic measuring cup
1		shovel
1		hoe
1		steel cement-finishing trowel
1		framing square
1		wrecking bar
1		electric drill
1		⅝" speed bit
1		slump-test cone (16 oz. paper cup)

Supplies (Group of 5)

2	pcs.	12", 16 gauge black iron wire
10		6d box nails
½	can	cement

1¼	can	sand
1¾	can	gravel (less than ¾″)
1	pc.	1″ x 2″ x 8″ wood for agitating
1	pc.	1″ x 3″ x 18″ wood for screeding
1	pc.	plastic sheeting *or* building felt
2		½″ x 6″ square head bolts with hex nuts/washers
		30 W oil
		rags

Overview (5)

Yesterday you watched a demonstration on how to mix, place, and finish concrete. Today you will mix, place, and finish concrete in your footing form.

1. In your reading you learned about unloading and moving concrete, placing it, and leveling it. You read about floating and finishing concrete.
2. I will review how to mix, place, and finish concrete.
3. In your laboratory activity, you will mix, place, and finish the concrete.

Lecture-Discussion (5)

You have already had experience in mixing, placing, and finishing concrete. Today I will explain a technique for locating and placing bolts in the concrete columns.

1. Make sure all the students understand that today's laboratory tasks will be basically the same as yesterday's demonstration. Review the processes of proportioning, mixing, testing, placing, rodding, screeding, and finishing concrete.
2. Structural elements can be joined to a concrete footing in two ways:
   a. Casting a concrete element in place with a common reinforcement.
   b. Bolting the element in place. Explain.

Laboratory Activity (35)

Concrete will be proportioned, mixed, tested, placed, rodded, screeded, and finished in the footing forms.

1. Have the students read through their problem in the Laboratory Manual.
2. Assign each group a turn 1, 2, 3, 4, etc. for using the mortar box and wheelbarrow.
3. After screeding, have students clean up tools while they are waiting for the concrete to set enough for finishing.
4. Make sure that the students clean all tools and equipment after they have been used. The need to control the disposal of water used in cleaning is important.
5. After finishing, have students cover their forms for protection and curing. Have students return all tools and equipment to storage.
6. If time remains, you may want to discuss how concrete is brought to and worked on a construction site. Point out the practices used on a site and the practices the students have used.

Homework

Reading 42

ASSIGNMENT 75, UNIT 42

Completing Foundations

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to completing foundations:
   a. Describe what happens when concrete cures.
   b. List two reasons why some hardened concrete surfaces must receive a final surface finish.

Laboratory Activity

2. Given the equipment and supplies, remove and clean forms and provide for concrete to cure properly.

Discussion

3. Given the activity of placing concrete and stripping forms:
   a. State how long it takes for concrete to set and cure.
   b. State why concrete should be kept moist while curing.
   c. Relate personal observation of concrete work on a construction site.

Time Schedule

5	Overview
10	Lecture
20	Laboratory Activity
10	Discussion

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	claw hammers
1	paint scraper
1	12″ wrecking bar

Supplies (Group of 5)

1	plastic sheet *or* building felt

Overview (5)

Yesterday you learned about placing and finishing concrete. Today you will remove the forms and provide for the concrete to cure.

1. In your reading you learned that concrete needs time to set. You read about removing forms and treating the formed surfaces.
2. I will explain how concrete should be cured.
3. In your laboratory activity, you will remove the forms and provide for curing the concrete.

Lecture (10)

The curing of a concrete slab is one of the most important construction operations, but it is often one of the most neglected. Today you will learn how concrete should be cured.

1. Different techniques are needed to protect concrete, depending on whether it is placed in the summer or in the winter.
2. For summer work, these precautions should be taken:
   a. The weather forecast should be checked.
   b. The necessary equipment and material should be prepared.
   c. An ample water supply for curing and for sprinkling subgrades and forms should be secured. This is done to prevent the surroundings from absorbing the moisture from the concrete.
   d. Material for sunshades and windbreaks should be secured. This helps prevent water from evaporating from the concrete.
   e. The concrete should be scheduled to be placed during cool afternoons.
3. Exposed surfaces need the following treatment:
   a. To keep the concrete wet, it should be sprinkled with a hose.
   b. If practical, make a pool of water on the slab by building up the bank of earth on the edges.
   c. Keep it wet from three to seven days. This is done because water acts as a curing agent, and cools the concrete.
4. For cold weather:
   a. Concrete between 50° and 70°F should be used.
   b. Frozen materials should not be used.
   c. Materials should not be overheated.
   d. Concrete should not be placed on the frozen ground.
   e. All ice and frost should be removed from forms and steel reinforcing.
   f. To hasten hardening, a pound of cal-

cium chloride per sack of cement should be used.

5. For curing concrete:
   a. Concrete made with normal portland cement should be kept at 70°F for three days. If the surface temperature is under 70°F, it should be kept longer.
   b. Temperature of high, early-strength concrete should be maintained at 70° for two days.
   c. Concrete should be cooled gradually (1° to 2° per hour) until it reaches outside temperatures.
   d. In summer, concrete should be kept moist and cool. In winter, concrete should be kept moist and warm with heat from a stove. Do not let concrete freeze.

Laboratory Activity (20)

The class will remove the forms from the concrete.

1. Two students will remove the footing and column form with a wrecking bar.
2. Two students will remove all nails from the form materials.
3. One student will scrape the forms to remove any extra concrete and will store the form materials as directed.
4. Make sure students understand that care must be exercised because the concrete is green.
5. Dampen concrete.

Safety Precautions

1. Boards that have nails sticking up must not be left on the ground or on the floor.
2. Be careful to watch where you are stepping.
3. Do not run. Look out for hazards on the floor.

Discussion (10)

You may use the time to talk about concrete *or* use it to start setting up the jenny winch boom.

1. How long does it take for concrete to set? (About 12 to 24 hours.)
2. How long does it take for concrete to cure? (14 to 28 days.)
3. Did you notice any heat in the concrete? If so why was there heat? (Chemical reaction.)
4. Why should concrete be kept moist for the first 2 weeks? (For proper curing. Concrete gets harder as it is exposed to water.)
5. Can any of you tell about concrete jobs that you have seen on a construction site? What was going on?

Homework

Reading 43

ASSIGNMENT 76, UNIT 43

Building Superstructures

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to building superstructures:
   a. Classify the following superstructures as (a) mass, (b) loadbearing, or (c) framed:
      1) your home
      2) your school
      3) television tower
      4) highway overpass
      5) earth dam
   b. Describe the way in which a framed structure is like the human body.

Laboratory Activity

2. Given various kinds of superstructures, match each superstructure with a suitable material.

Time Schedule

5 Overview
10 Lecture
10 Laboratory Activity
20 Demonstration

Equipment and Supplies for Demonstration

Equipment

2	brick trowels
1	jointing tool
1	2 ft. masonry level
1	hand garden trowel
1	12″ rule
1	chalk line
1	1 qt. measure
1	mortar box
1	mortar board
1	cup measure

Supplies

5	8″ x 8″ x 16″ concrete blocks	
2	8″ x 8″ x 8″ concrete blocks	
1.6 qt.	masonry cement	to be mixed in one batch
5 qt.	sand	
4	3″ x 12″ x 12″ concrete footings	

Overview (5)

Your recent activities have concerned the building of foundations. Today you will begin a series of activities that deal with superstructures.

1. In your reading you learned that superstructures are built on top of foundations or substructures. You also learned about the different kinds of superstructures.
2. I will tell you more about the basic kinds of superstructures and their relationship to substructures.
3. In your laboratory activity, you will identify the different types of materials that are used with different superstructures.
4. I will demonstrate how to mix mortar, lay out an area for the mortar bed, and lay concrete block to build a load bearing wall.

Lecture (10)

The basic kinds of superstructures (framed, load bearing, and mass) have a relationship to substructures and soil conditions.

1. Many kinds of superstructures are constructed above ground. Discuss examples.
   a. Homes—small buildings
   b. Large buildings—skyscrapers, etc.
   c. Roads and runways, parking lots, etc.
   d. Bridges, television towers, oil derricks, high tension electric service towers
   e. Dams
2. Not all substructures have related superstructures above ground. Tunnels, canals, and underground piping are among these exceptions.
3. A substructure must be appropriate to the superstructure which it is to support. The height, weight, and kind of superstructure determine the kind of substructure.
   a. A high rise apartment requires a different substructure than would be required for a single family home.
   b. An airport runway requires a different substructure than would a TV tower.
   c. A bridge requires a different substructure than would a dam.
4. There are three basic kinds of superstructures.
   a. **Framed**—possessing a skeletal framework. Examples include skyscrapers, utility line towers made of structural steel, and wood framed homes.

b. **Load bearing** or bearing wall. These could be called "limited mass" superstructures. The walls do not have a framework. (The roof may.) This kind of superstructure is not a solid mass like a dam or solid monument. It contains rooms or other enclosed space. I will demonstrate how to build a load bearing wall.

c. **Mass**—made of materials from the earth and have a solid cross section.

Laboratory Activity (10)

1. In Problem 1, students are to match each superstructure with the building materials from which it commonly is made.
2. While students are working in the Laboratory Manual, set up the demonstration.

Demonstration (20)

1. Before class, arrange the necessary equipment and supplies in convenient areas. Place four concrete footings side by side. Demonstrate the building of a masonry load bearing wall. Have students get their Laboratory Manuals and follow Activity 44 as you demonstrate.
2. Show how to snap chalk lines on the footings to guide the placement of mortar. See Fig. 44-1 in the Laboratory Manual.
3. Have a few students help in mixing the mortar. (1.6 qt. masonry cement, 5 qt. sand, and enough water to make the mortar stand.) This will lay up two courses.
4. Group the students around the work area so that all can see the demonstration.
5. Lay two mortar beds along the chalk lines on the footing.
6. Lay the end block and level.
7. With mortar, butter one end of the second block. Place this into position with the buttered end against the first block. Level the block. Lay the third block and level.
8. Butter the top of these blocks and lay the next ½ block in position on the top. Plumb the end.
9. Level the blocks as you lay them, and check the alignment with a straightedge.
10. In the limited time available, only a few blocks can be laid.
11. If time allows and the mortar is thumbnail hard, demonstrate the pointing up of the joints. Explain that pointing improves the looks and the water seal and makes the surface smooth.
12. Explain that since the concrete footing will be needed for other classes they will need to tear down the load bearing wall. Demonstrate how materials are to be cleaned up.

Homework

Reading 44

Answers for Laboratory Manual

Problem 1

1. f
2. c
3. a
4. e
5. c
6. a
7. b
8. c
9. a
10. d

ASSIGNMENT 77, UNIT 44

Building Mass and Masonry Superstructures

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to building mass and masonry superstructures:
   a. Give reasons why a highway or an airport runway may be considered a mass superstructure and give reasons why they may be considered as substructures.
   b. Give one example of how brick and stone are used in building construction other than being used in a load bearing wall superstructure.

Laboratory Activity

2. Given the equipment and supplies, mix the mortar, lay out the area for the mortar bed, and lay and level concrete block to build a bearing wall.

Time Schedule

5 Overview
40 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	brick trowels
1	jointing tool
1	2 ft. masonry level
1	hand garden trowel
1	12″ rule
1	chalk line
1	qt. measure
1	mortar box
1	mortar board
1	mason's line

Supplies (Group of 5)

4	8″ x 8″ x 16″ concrete blocks	
2	8″ x 8″ x 8″ concrete blocks	
8 qt.	masonry cement	
24 qt.	sand	to be mixed in one batch
6 qt.	water	
4	3″ x 12″ x 12″ concrete footings	
1 sht.	building felt 3′ x 6′ *or* equiv.	

Overview (5)

1. In your reading you learned about mass construction and bearing wall or masonry construction.
2. Yesterday you watched a demonstration on laying block to build a bearing wall.
3. In your laboratory activity you will lay out the work, mix mortar, and lay blocks on your footings to build a bearing wall.

Laboratory Activity (40)

Today the students will lay concrete blocks on their footings.

1. The teacher should give specific instructions for the students to follow in the laboratory activity.
   a. Students should work in groups of five.
   b. The class will mix all their mortar together as one batch in the mortar box. Batch proportions ¾: 1:3. Start with ¾ water and add more if necessary.
   c. Follow the instructions in the Laboratory Manual.
   d. Tell the class that after the mortar is thumbnail hard (later in the period), they will tool all exposed joints. Explain that pointing improves the looks and the water seal and makes the surface smooth.
   e. Allow enough time for cleaning up. The last 10 minutes of class should be used to tear down the foundation wall, scrape off all mortar, wash all tools and equipment thoroughly in water, and return the tools and materials to their proper places.
2. The teacher should observe the students, offer suggestions, and answer questions.
3. This activity allows the students to become familiar with the materials, tools, and skills necessary to construct a concrete block bearing wall.
4. The mortar may be salvaged by adding a little water and using it for the next class. Used mortar should be placed in a container to be disposed of later.

Caution

Do not wash mortar down the drain. Mortar should be washed from tools and materials in a specially prepared area. *Mortar which is not washed off will harden and is not easily removed.*

Homework

Reading 45

ASSIGNMENT 78, UNIT 45A

Erecting Steel Frames

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to erecting steel frames:
    a. Name the piece of equipment other than a derrick used to hoist steel shapes into place.
    b. Compare the advantages of steel-framed superstructures to mass superstructures and load bearing superstructures.

Laboratory Activity

2. Given a set of working drawings:
    a. Read the drawings.
    b. Lay out concrete footings and columns.
    c. Assemble steel columns to the concrete footings.
    d. Assemble brackets to the steel columns.
    e. Erect a steel frame.

Time Schedule

5	Overview
40	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

4	12″ drift pins, tapered from ¼″ to ½″ diameter *or* spud wrench with same taper
1	12′ steel measuring tape
4	adjustable wrenches *or* ½″ socket wrenches
1	jenny winch boom
2	4″ x 8′0″ H-beams
2	4″ x 4′0″ I-beams
2	4″ x 1′0″ H-beams
4	I-beam bracket sets

Overview (5)

1. In today's reading you learned that steel frames, assembled by ironworkers, are set in place piece by piece with a crane. Steel framing pieces may be connected by bolting, riveting, or welding. After the lower part of a structure has been erected, the steel frame is plumbed and braced with guy wires.
2. In today's laboratory activity, you will be given the opportunity to erect a steel frame. You will place and bolt steel columns into place on the concrete footing and columns which you constructed earlier.

Laboratory Activity (40)

It is suggested that the first class of the day assemble the brackets and steel columns to the concrete columns. The remaining classes can spend the time erecting the steel frame. The remaining classes would therefore follow Activity 45B, Problems 1, 2, 3, and 4. The first class will get a chance to erect the steel frame in Activity 45B.

First Class

1. Students will individually read the working drawings. Then, as a class, they will move and lay out the concrete footings in the middle of the floor.
2. During the bracket assembly, the class will be broken into four groups. Each group will assemble one corner bracket, as directed in the Laboratory Manual.
3. Leave the brackets and columns assembled and have the students answer questions in the Laboratory Manual.

Remaining Classes

4. The next class is to assemble the steel frame according to Activity 45B.

Safety Precautions

1. Concrete footings are heavy; care must be taken in moving them.
2. The steel beams are heavy; they can injure someone if dropped.
3. Handle these beams carefully, for they have sharp edges.

Homework

None

Answers for Laboratory Manual

1. On center.
2. Easier to get at, to tighten.

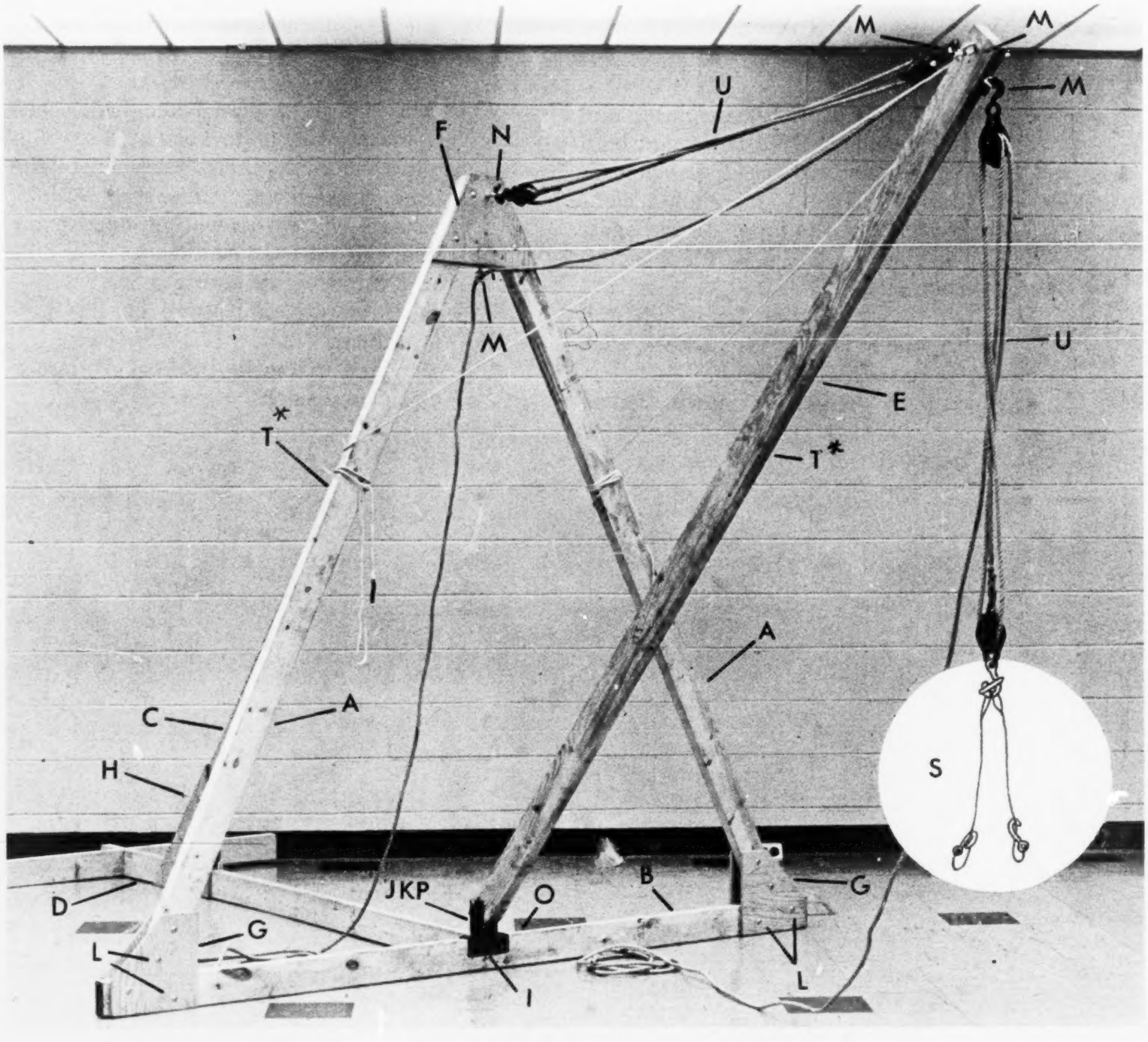


Fig. 78-1. Jenny Winch Boom Assembly

Directions for Assembling Jenny Winch Boom

A. Preparation
  1. Unpack parts and check for shortages.
  2. Cut gussets from ½″ plywood, using cardboard patterns as your guide.

B. Step-by-Step Procedure
  1. Lay 2 x 4's A and B so that they form a triangle. Mark a square line around B, 3½″ from each end.
  2. Stand B on its edge. Mark the center. Drill a ½″ hole all the way through; then counterbore a 1″ hole, 1″ deep on the bottom.
  3. Overlap A's at the top so that you have as little waste as possible. Align the other end to overlap B on 3½″ marks.
  4. Mark angles and saw bottom angles. Then realign the top and saw a mitre at the top.
  5. Place gussets F and G in place; nail to hold in place. Drill holes and bolt. Note: On the top gusset, the bolt on the top right-hand side should clear the position of the hinge on the back.
  6. Cut a piece of 2 x 4 to fill in space between gussets F.
  7. Stand the triangular frame up and secure one side in a vise. Check with a level to see if it is plumb.
  8. Place D in position as shown. Center of hole on B should line up with center marked on D. Lay out and fasten a hinge on each side.
  9. Place C in position; mark and saw the angles.
  10. Drill holes and bolt rear gusset to C and D.
  11. Place the hinge at the top of C in position and fasten it.
  12. Place Plate I so that the hole for the bolt that holds the yoke is in position; fasten it with wood screws.
  13. Place washer K next to the plate and bolt yoke J to B.
  14. Mark and saw rounded end on E. Shim up to position, drill ½″ hole in the boom, and fasten the boom to the yoke.
  15. Drill pilot holes. Screw hook eyes and fasten cleats as shown.
  16. Attach block and tackles, and tie guy wires to screw eyes.
  17. The jenny winch boom will need some anchoring to keep it from tipping when weight is fastened to the end of the boom. This can be done several ways, depending upon your shop situation.
      a. Place weights on the rear.
      b. Have students stand on the stabilizer.
      c. Place extended part of D under a low bench.

Materials List for Jenny Winch Boom

Item	No. of Pieces	Description	Size and Material
A	2	Uprights of triangle	2" x 4" x 8' Fir
B	1	Bottom of triangle	2" x 4" x 8' Fir
C	1	Support (top to rear)	2" x 4" x 10' Fir
D	1	Bottom Brace	2" x 4" x 8' Fir
E	1	Boom	2" x 4" x 10' Fir
F	2	Gussets (top)	½" x 10" x 14" Plywood
G	4	Gussets (front)	½" x 10" x 10" Plywood
H	2	Gussets (rear)	½" x 16" x 18" Plywood
I	1	Plate	⅛" x 2" x 5½" Angle Iron
J	1	Yoke	¼" x 2⅛" x 4" 2" Band Iron
K	1	Washer	⅛" x 1-¾"
			w/¾" or ⅝" holes
L	16	Carriage Bolts	5/16" x 3", w/nuts and washers
M	4	Hook Eyes	⅜", w/1" eye
N	1	Eye Bolt	¼", w/¾" eye
O	1	Machine Bolt	½" x 4", w/hex nut and washer
P	1	Machine Bolt	½" x 3", w/hex nut and washer
Q	3	Butt Hinges (loose pin)	⅛" x 1½" x 3½"
R	3	Nylon Ropes	¼" x 15'
S	1	Choker Set, as follows: 2 hooks, ¼" 2 U-bolt cable clamps 2 pc ¼" steel cable, 30" length	
T	4	Cleats, awning type	
U	2	Block & Tackle Sets w/rope:	1 40' length, ⅜" rope 1 35' length, ⅜" rope

ASSIGNMENT 79, UNIT 45B

Erecting Steel Frames

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a problem of erecting a steel frame:
   a. Demonstrate skill in assembly using full-size materials.
   b. Demonstrate skill in aligning by squaring, leveling, and plumbing the columns and beams of the steel frame.
   c. Demonstrate the operation of a boom by operating, rigging, hoisting, and setting steel by use of hand signals.

Time Schedule

5 Overview
5 Lecture
35 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Problem 1

Equipment (Group 1)

2	4″ x 8′0″ H-beams
2	4″ x 4′0″ I-beams
4	4″ x 1′ preassembled H-columns
4	concrete footings and columns (should already be in place)
2	stacking timbers (2″ x 4″ x 2′)

Problem 2

Equipment (Group 2)

2	jenny winch boom
2	guy lines (15′ of ¼″ nylon rope)
2	tag lines (15′ of ¼″ nylon rope)
2	choker sets (¼″ steel cable with hooks)
1	double pulley block and tackle (small)

Problem 3

Equipment (Group 3)

1	2 ft. spirit level
1	framing square
4	spud wrenches *or* open-end wrenches
4	½″ drift pins, if open-end or adjustable wrenches are used rather than spud wrenches

Supplies (Group 3)

Assorted metal shims from scrap sheet metal

Overview (5)

1. Today you will continue erecting the steel frames you began work on yesterday.
2. You will complete the steelwork assembly, test it, and disassemble it during today's laboratory period.

Lecture (5)

The students, working in three groups, will participate in rigging, assembling, and aligning structural steel members.

1. There is a great deal of work to accomplish today. As soon as I have explained the activity, you are to meet in your assigned work groups. You will have 30 minutes in which to erect a steel frame.
2. Yesterday you measured the spacing for the concrete footings. Now that these are properly spaced, you will erect a steel frame which will rise from the four columns.
3. The structural steel pieces are already prepared for the frame. They are ready for you to assemble on the site. As you recall from your reading, a steel fabricating company fabricates or makes pieces of steel to the sizes needed for a construction job. They are then delivered to the site where they are ready to be assembled.
4. In erecting this frame today, each of you will do some jobs and observe many other kinds of jobs which steel and ironworkers do.
5. You will work like real construction workers in crews or work groups. Each group must carry out its job efficiently. Through the cooperative efforts of all three groups, our structural frame will take shape today.
6. When your group is not involved in actual work, you are to observe the other groups, so that you will all understand what practices are involved in erecting a typical steel frame.
7. Be sure to keep safety in mind today. As steelworkers go about their work,

they must observe various safety practices. Heavy steel pieces must be properly lifted, securely fastened for safe hoisting, watched for sharp edges and burrs, and kept clear for sure footing at great heights. Remember all these safety precautions as you go about your work today.

8. After the frame has been completed and approved, you must all take part in disassembling it so the next class can erect the same kind of frame.
9. The teacher should call for disassembling with at least 8 minutes of class time remaining. The last class should leave the assembly erected for tomorrow's activity.
10. Let's now go to work, remembering to work accurately, safely, and cooperatively.

Laboratory Activity (35)

The students will erect a steel frame, using materials of full size. They will work in three groups, each assigned to complete a specific phase of the steelworker's job.

1. The students will work in the same group to which they were assigned yesterday. Groups 1, 2, and 3 will study Problems 1, 2, and 3 respectively. They will then proceed to Problems 4 and 5. Rotate each group through the jobs so that each group gets a chance to do each activity.
2. Yesterday the students placed the four footings and assembled the steel columns to the concrete columns. Today they continue the assembling of the frame.
3. Instruct students to follow carefully the instructions in the Laboratory Manual.
4. The teacher should have the steel framing pieces readily available.
5. The footings measured and placed on Assignment 78 should be in position on the floor, ready for use.
6. A trial run in operating the boom may be helpful to the students.
7. Because there will only be a limited amount of time available, all students will need to participate in the disassembling of the structure (Problem 5) for the next class. *The last class should leave the steel structure standing.* It will be disassembled by the last class in Activity 46.

Safety Precautions

Steel beams are heavy and can injure you if dropped. Therefore, care should be used in attaching the chokers to a beam and lifting it into position with the jenny winch boom.

Homework

Reading 46

ASSIGNMENT 80, UNIT 46

Erecting Concrete Frames

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to erecting concrete frames:
   a. Give reasons why the concrete used in concrete-formed superstructures must be stronger than the concrete used in foundations.
   b. List some advantages of using precast concrete shapes and give reasons why more or less precast structural members will be used in the future.

Laboratory Activity

2. Given the instructions, illustrations, and specifications,
   a. Build forms for making concrete frames.
   b. Construct, plumb, and level shoring members.

Time Schedule

5 Overview
5 Demonstration
35 Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	plumb bob and line
1	steel framing square
1	2′ spirit level

Equipment and Supplies for Laboratory Activity

Problem 1

Equipment (One group per class)

2	claw hammers
1	try square

Supplies (One group per class)

6 pcs.	1″ x 6″ x 7′8″ pine *or* equiv.
6 pcs.	1″ x 2″ x 8″ pine *or* equiv.
50	6d common nails

Problem 2

Equipment (Group of 5)

2	claw hammers
1	framing square

Supplies (Group of 5)

6 pcs.	2″ x 4″ x 3′ fir *or* equiv.
4 pcs.	1″ x 2″ x 1′6″ fir *or* equiv.
50	6d common nails

Problem 3

Equipment (Class)

	all hammers and squares from Problems 1 and 2
1	plumb line
1	2′ spirit level

Supplies

	steel frame from Activity 45
2	forms, from Problem 1
8	shoring members, from Problem 2

Overview (5)

1. The text reading described the different concrete framing elements and explained the building of different forms, reinforcing, placing concrete, curing the concrete, and removing the forms.
2. I will show you how to use the plumb line and carpenter's level to check forms and shoring. I will also explain the use of shoring.
3. The activity for today will be carried out in two stages. One part of the class is to build forms for concrete frame elements. The other class members will build shoring members to be used in completing the assembly of the form.
4. The class then will fasten the form in position by supporting it on the shoring, and level and plumb the positioned forms.

Demonstration (5)

1. Working with the edge and top surface of a workbench or desk, review the use of a plumb line and carpenter's level to check whether the form and shoring are plumb and level.
2. Explain why the plumb line and level are important in building formwork for concrete frames. (If the forms are not true, the framework will be crooked.)

3. Explain why shoring is used. (The forms alone would collapse under the weight of the concrete.)
4. Provide examples of shoring and formwork. (Pictures of structures being constructed locally using concrete frames or refer to textbook figures.)

Laboratory Activity (35)

The class will work in groups of five, with one group assembling two forms and the remaining groups each assembling two shoring members.

1. Appoint one group to complete Problem 1; the remaining groups are to complete Problem 2. Then the whole class will complete Problems 3 and 4.
2. The materials used for Problem 1 and Problem 2 may be used later for the construction of the wood frame unit.
3. Observe the class as the groups perform the work tasks, and provide assistance and explanations when necessary.
4. When the groups complete Problems 1 and 2, have the class place the forms and shoring. Use the class organization in giving supervisory and work-order assignments.
5. The activity for this assignment may extend into Assignment 81, which is an optional assignment. If you plan on continuing this activity during the optional day, *do not* have the students do Problems 3 and 4.
6. Check to see that the class has positioned the form correctly and to determine if it is plumb and level.
7. If Optional Assignment 81 is not used, have the last class of the day disassemble the steel frame. See Problem 5, Activity 45B.
8. After the form has been checked, have it dismantled and the tools and materials returned to storage.

Homework

If you plan to omit Optional Assignment 81, have the students bring textbooks to class for the optional review of Readings 36-46. If the review option is not used, there is no homework.

ASSIGNMENT 81, UNIT 46
OPTIONAL

Erecting Concrete Frames

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the task of building formwork for a concrete frame; plumb, level, and dismantle constructed forms and shoring.

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

1. This period may be used to complete Activity 46 or another laboratory activity the class has not experienced.
2. The period can serve as a discussion period of some topic related to the construction industry which is of interest to both you and the class.
3. You may wish to bring in an outside speaker to talk to your class. Suggested topics of discussion are
   a. The importance of safety in construction work.
   b. How construction personnel work together.
   c. The demand for skilled construction workers in today's economy.
   d. The importance of industrial arts education.
4. Remind the students to bring their textbooks to class for the review of Readings 36 to 45.

Homework

Review of Readings 36 to 46. If Optional Assignment 82 is not used, there is no homework.

ASSIGNMENT 82, Units 36-46
OPTIONAL

Review 36-46

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given a review of Units 36-46, ask and answer questions about building structures, setting foundations, building forms, setting reinforcement, placing concrete, completing foundations, building superstructures, and erecting steel and concrete frames.

Time Schedule

45 Discussion or Laboratory Activity

Discussion or Laboratory Activity (45)

This review time can be used in various ways. Plan to do one of the following alternatives.

Alternatives

1. Students can play the "Big Builder" game to become more familiar with the concepts and processes of construction.
2. Pose the questions and situations at the end of each reading to stimulate thinking and discussion.
3. Have each group of students get together and list two or three words or concepts they would like to have explained or discussed. Discuss and clarify the concepts.
4. Ask a guest speaker knowledgable about foundations or superstructures to talk to the class. Schedule the speaker for the first class period and tape record his talk so it can be played to your other classes.
5. Schedule a field trip to a construction site where a superstructure is being built.

Homework

None.

ASSIGNMENT 83

Test No. 5

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given IACP Construction Test No. 5, select the correct responses from a list of items to concepts presented in Readings 36 to 46.

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

1. Seat the students to best advantage for administering a test.
2. Distribute pencils, erasers, and eraser shields.
3. Distribute answer sheets, and have students fill out needed information.
4. Pass out test booklets. "Keep closed until I say to begin."
5. Read directions for filling in answers. Open test booklets and begin.
6. Allow 35 minutes for completion; then collect answer sheets, then test booklets.
7. Review the test with students to provide feedback.

Homework

Reading 47

Answers for Test No. 5

1. B   2. A   3. D   4. B   5. C   6. B   7. C   8. D   9. A
10. A   11. C   12. A   13. B   14. C   15. A   16. B   17. A   18. B
19. D   20. C   21. A   22. D   23. B   24. B   25. C   26. A   27. A
28. C   29. D   30. D   31. B   32. C   33. B   34. A   35. D

ASSIGNMENT 84-85, UNIT 47A AND B

Building Wood Frames

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to erecting wood frames:
   a. Give reasons why wood framing is used for structures such as houses.
   b. Compare the advantages and disadvantages in building wood-frame structures in a factory and transporting them to the site.

Laboratory Activity

2. Given the equipment, supplies, and instructions, measure, mark, and saw materials to length and assemble the rough floor framing of a model structure.

Time Schedule 84

5 Overview
10 Demonstration
30 Laboratory Activity

Time Schedule 85

45 Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	try square
1	crosscut saw
1	claw hammer
1	12′ steel tape
1	framing square

Supplies

1 pc. 2″ x 6″ x 8″ (joist)
1 pc. 2″ x 6″ x 12″ (header)
1 pc. 2″ x 4″ x 12″ (sill)
8d nails
16d nails
1 pencil

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	try square
1	crosscut saw
1	claw hammer
1	steel tape
1	framing square
5	nail aprons

Supplies (Group of 5)

1 pc. 2″ x 6″ x 10′ lumber

1 pc. 2″ x 4″ x 8′ lumber
1 pc. 2″ x 4″ x 4′ lumber (skids)
16d common nails
8d box nails
1 pencil

Overview (5)

In your next activities, you will learn how to lay out, measure, saw and fabricate wood frames. Today you will begin fabrication of the floor structure.

1. I will demonstrate various techniques for measuring, laying out, and sawing the materials needed for the floor structure.
2. I will also show you how to assemble the various parts of the floor so that a sturdy structure can be built according to the plan in your Laboratory Manuals.
3. You will be shown the difference between face nailing and toenailing.
4. In the laboratory activity, you will lay out and saw materials to length and nail them together to form the floor structure of the wood frames.

Demonstration (10)

Today the students will lay out and saw to length the structural members of the floor platform. The following should be demonstrated before the activity begins:

1. Explain that 2 x 4's and 2 x 6's are not 2″ x 4″ or 2″ x 6″ exactly. Rather, the dressed lumber measures 1⅝″ x 3⅝″ and 1⅝″ x 5⅝″. Caution the students to be very careful in measuring and marking.
2. Demonstrate measurement, marking a line square with a try square and sawing with a crosscut saw.
3. Show how the header can be nailed to the joist as shown in Fig. 84-1. Explain the difference between face nailing and toenailing.
4. Demonstrate toenailing. See Fig. 84-2. Show where toenailing is necessary on the floor structure (from the header into the sill, and from the ends and sides of the joists into the girder plate).
5. Show the students how to locate and mark the positions of the joists on the header, the sill, and girder plates. Use a framing square to mark all three boards at once. See Fig. 47A-4 in the Laboratory Manual.

Laboratory Activity (30)

1. Divide the class into groups of five students each. Distribute equipment and supplies.
2. Move about the laboratory and check measurements. Answer questions and help wherever necessary.
3. Instruct the students that they will have two days to complete the rough framing.
4. Assign a storage area for each group. (Note: You may wish to mark each group's floor structure with a colored pen so that there will be no mixup with the structures of other groups and classes.)

Safety Precautions

1. Keep fingers out of the way when using a hammer to drive nails.
2. Keep fingers away from the cutting edges of the saw.

Homework

None

ASSIGNMENT 86, UNIT 47C

Building Wood Frames

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a wood floor structure, construct bridging in the floor structure and install the subfloor.

Time Schedule

5	Overview
10	Demonstration
30	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	try square
1	framing square
1	pencil
1	crosscut saw

Supplies

1	floor structure
1 pc.	2″ x 6″ x 16″ solid bridging
1 pc.	1″ x 2″ x 36″ bridging
1	½″ x 15½″ x 48″ plywood subfloor

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	try square
1	crosscut saw

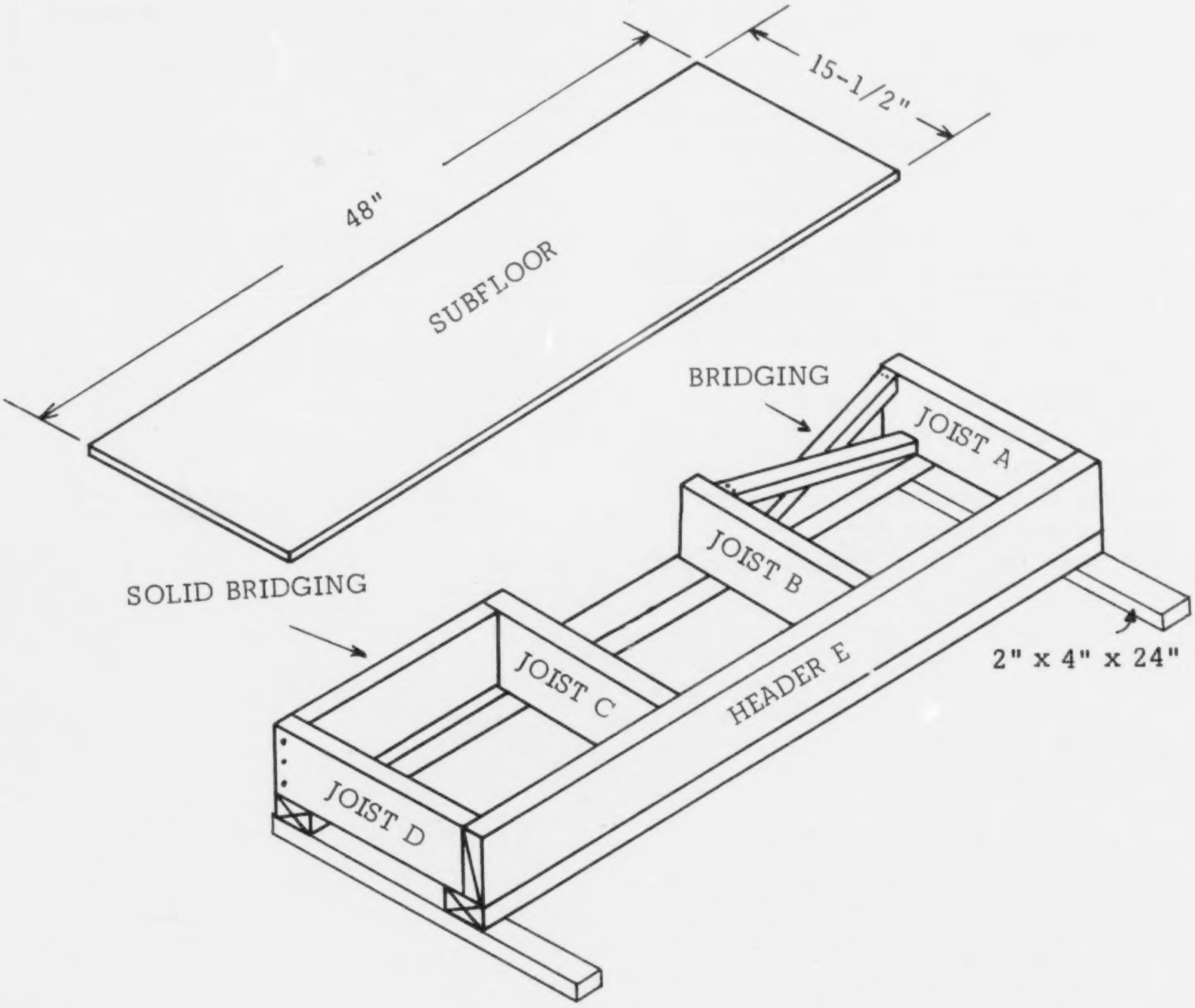

48"
15-1/2"
SUBFLOOR
BRIDGING
JOIST A
JOIST B
SOLID BRIDGING
JOIST C
HEADER E
2" x 4" x 24"
JOIST D

Fig. 86-1

2 claw hammers
1 framing square
5 nail aprons

Supplies (Group of 5)

1 pc. 2″ x 6″ x 16″ solid bridging
1 pc. 1″ x 2″ x 36″ pine bridging
1 ½″ x 15½″ x 48″ plywood subfloor (from Activity 38A, B)
16d common nails
6d box nails
1 pencil

Overview (5)

1. Today you will continue building the wood frames that you started yesterday.
2. I will first give a demonstration on how to install two kinds of bridging, how to mark nailing lines on the subfloor, and how to install the subfloor.
3. You will then construct bridging and install it and a subfloor on your wood floor structures.

Demonstration (10)

1. Tell the students that if they haven't completed the floor structure from the last activity, they should complete it before going on with today's activity.
2. See Fig. 86-1. Refer the students to Fig. 47C-2 in their Laboratory Manual. Explain the difference between the two kinds of bridging shown in the illustration. (Both are used to stabilize the floor joists.)
3. Show them how to measure the length of the solid bridging. Demonstrate how to mark the angle of the 1″ x 2″ bridging. See Fig. 86-2. Show them how to saw the angle with a crosscut saw.
4. Show how the 1″ x 2″ bridging is nailed into place. (Note: It does not have to be nailed on the bottom because it is held in place by the joist and girder plate.)
5. Place the subfloor on the floor structure and demonstrate how the nailing lines are drawn for Joists B and C, using a framing square which is aligned with the center of each joist.

Laboratory Activity (30)

1. Distribute equipment and supplies to the groups.
2. Help those who are having difficulty with the laboratory activity.
3. Check measurements and squareness of the floor structures as you move from group to group.

Safety Precautions

1. Keep fingers away from cutting edges.
2. Keep fingers out of the way when hammering nails.
3. Be careful when handling large-size materials.

Homework

None

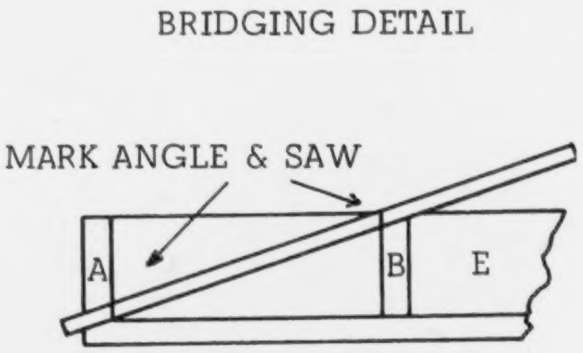


Fig. 86-2

ASSIGNMENT 87, UNIT 47D

Building Wood Frames

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

Given a wood frame floor structure, lay out the wall plates and studs, cut them to length, and assemble the wall sections.

Time Schedule

5	Overview
10	Demonstration
30	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	claw hammer
1	try square
1	framing square

Supplies

2	2″ x 4″ x 4′ (sole plates and studs)
3	2″ x 4″ blocks
	16d common nails
	8d box nails

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	steel tapes
2	try squares
1	framing square
2	claw hammers
2	crosscut saws
5	nail aprons

Supplies (Group of 5)

5	2″ x 4″ x 8′ studs
1	1″ x 4″ x 36″ (brace)
	16d common nails
	8d box nails
3	pencils

Overview (5)

1. We will continue building the wood frames today. Those who didn't finish the last activity should finish it before going on to the activity for today.
2. I will give a demonstration of laying out top and bottom plates of the wall sections.
3. I will show you how to construct a corner. I will also demonstrate the proper technique of toenailing the studs to the bottom plates.
4. In today's activity, you will erect the wall sections of the wood frame structure.

Demonstration (10)

Review Fig. 47D-2 in the Laboratory Manual with the students, and explain how the parts are assembled. Answer any questions that may arise. See Fig. 87-1.

1. Demonstrate laying out the top and bottom plates of Sections A and B.
2. Using two 2″ x 4″ studs and three 2″ x 4″ blocks, show how the corner of Section B is assembled.
3. Demonstrate nailing the top plate to the studs by placing the stud on the floor. See Fig. 87-2.
4. Demonstrate the use of the framing square in checking the square of the studs with the floor section and other parts of the structure.

Laboratory Activity (30)

1. Distribute materials and tools to the groups.
2. Help groups with measurements and layout wherever necessary.
3. You may have to help some groups with toenailing the studs to the plates.
4. If the students don't finish the activity, they may continue it the following day.

Safety Precautions

1. Keep fingers away from cutting edges.
2. Keep fingers out of the way when hammering.
3. Be careful when handling long pieces of material.

Homework

None

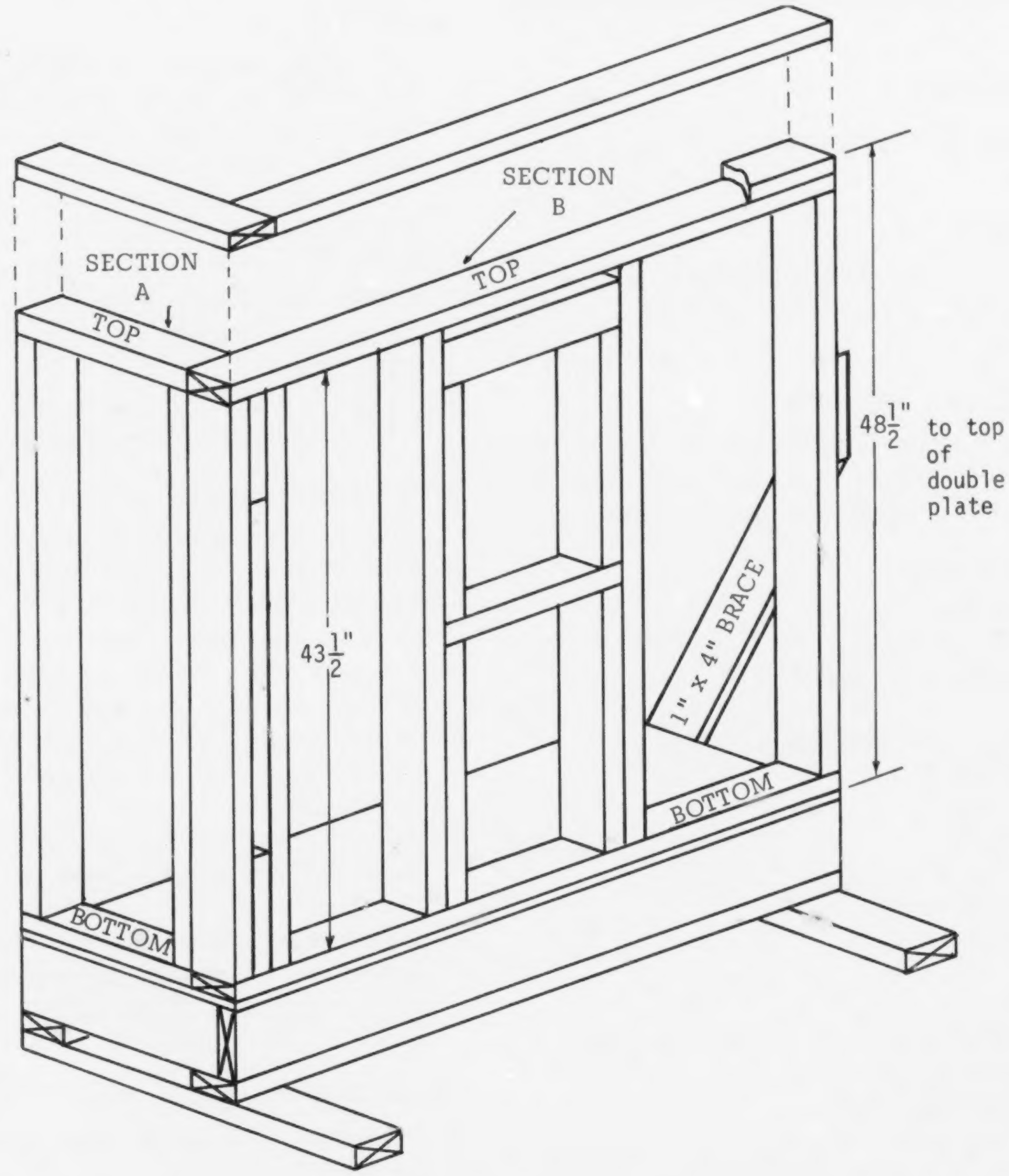

SECTION
B
SECTION
A
TOP
TOP
48$\frac{1}{2}$" to top of double plate
43$\frac{1}{2}$"
1" x 4" BRACE
BOTTOM
BOTTOM

Fig. 87-1. Wall Frame Assembly

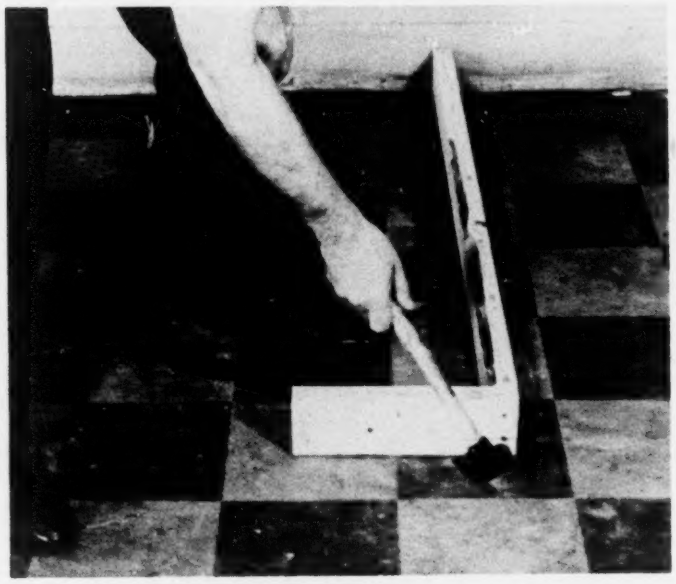


Fig. 87-2. Nailing Top Plates

ASSIGNMENT 88, UNIT 47E

Building Wood Frames

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

Given the wood frame structure, construct and install the window frame, header and double plates.

Time Schedule

5 Overview
10 Demonstration
30 Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	steel tape
1	try square
1	crosscut saw

Supplies

2 pcs.	2″ x 4″ x 40″ (window frame)
2 pcs.	3/8″ x 3″ x 6″ plywood (filler)
1 pc.	1″ x 6″ x 17 5/8″ (window sill)
1	pencil

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

3	claw hammers
3	crosscut saws
1	try square
2	steel tapes
5	nail aprons

Supplies (Group of 5)

2 pcs.	2″ x 4″ x 8′ (studs)
2 pcs.	3/8″ x 3″ x 6″ plywood (filler)
1 pc.	1″ x 6″ x 18″ (sill)
1 pc.	1″ x 4″ x 18″ (lintel)
	16d common nails
	8d box nails
2	pencils

Overview (5)

1. I will show you how a window frame is constructed and installed in a frame structure.
2. I will also show you how the double plates are nailed to the top plates to strengthen the structure.
3. In the laboratory activity, two members of your group will install the double plates and three will construct the window frame.

Demonstration (10)

1. Ask the students to turn to Activity 47E in their Laboratory Manuals. Discuss with them the procedures to be followed in installing the window frame and double plates.
2. Demonstrate how the pieces fit together as a whole. Specifically show them how to mark and cut the 2 x 4's for the window frame. Explain the dimensions of the sill. It is suggested that you have one cut out to size and show how it fits in the structure.
3. Explain why a 3/8″ plywood filler is needed between both 2 x 4 headers (so that the thickness of the 2 x 4's and the plywood will equal the width of the 2 x 4 studs).
4. Demonstrate how the double plate fits on top of the top plates of the structure. Explain how the overlap of the double plate on the corner adds strength to the structure.

Laboratory Activity (30)

1. Divide the class into groups of five and help them to get started with sawing the stock to length. Double check the student's measurements as often as possible before they begin to saw.
2. Give special assistance to those who are lagging behind the rest of the class in building the frames.

Safety Precautions

1. Keep fingers from cutting edges.
2. Keep fingers out of the way when hammering nails.
3. Be careful when handling large-size materials.

Homework

None

ASSIGNMENTS 89-92, UNIT 47F-1

Building Wood Frames

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a wood frame wall and floor structure, lay out, construct, and erect the roof trusses.
2. Given the completed frame structure, inspect the structure and evaluate the findings.

Time Schedule 89

5	Overview
15	Demonstration
25	Laboratory Activity

Time Schedule 90, 91, 92

45	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	framing square
1	steel tape

Supplies

1	upper chord (pattern)
1	lower chord (pattern)
1	gusset (pattern)
1	pencil

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	claw hammers
2	crosscut saws
2	steel tapes
1	try square
1	framing square
5	nail aprons

Supplies (Group of 5)

1 pc. 2″ x 4″ x 8′ (roof trusses)
1 pc. 2″ x 4″ x 48″ (braces)
1 pc. 2″ x 2″ x 48″ (soffit brace)
1 pc. 1″ x 6″ x 48″ (ridge board)
1 pc. 1″ x 6″ x 50″ (fascia)
1 pc. 1/2″ x 7″ x 22 1/4″ plywood (gussets)
16d common nails
8d box nails
1 3″ x 5″ card

Overview (5)

Today you will lay out, construct and erect the roof trusses, Fig. 89-1.

1. I will demonstrate and explain the various techniques that you will use in laying out the roof trusses.
2. Completing your roof framing will probably take the next three class periods.

Demonstration (15)

The instructor should have all the parts of a roof truss cut out and ready to assemble for this demonstration. Tell the students that this laboratory activity may extend over a 4-day period.

1. Go through the laboratory activity step by step with the students. Explain each illustration in the Laboratory Manual. Help students identify a truss, gusset, ridge board, fascia, and soffit.
2. Review the terms *run* and *rise*, and explain how they apply to a roof. (These terms were introduced in Assignment 35 in connection with stairs.)
3. Explain the term *pitch* (sometimes called slope).

$$\text{pitch} = \frac{\text{rise}}{\text{run}}$$

4. The roof trusses for the structure will have a pitch of about 6″ rise for 12″ run. Show this on the chalkboard:

$$\text{pitch} = \frac{\text{rise}}{\text{run}} = \frac{6}{12} = \frac{1}{2}$$

5. Spend some time explaining the use of the framing square to lay out and mark boards for roof trusses. Explain that the cutting angle for each piece must be correct so the pieces will fit together properly. Demonstrate laying out the upper and lower chords of a roof truss.
6. Demonstrate nailing the chords together.
7. Demonstrate the technique for laying out the soffit angle (Fig. 47F-8 in the Laboratory Manual).
8. Explain that the soffit nailer and the soffit angle on the roof truss will permit closing in the eave when students begin to install sheathing.

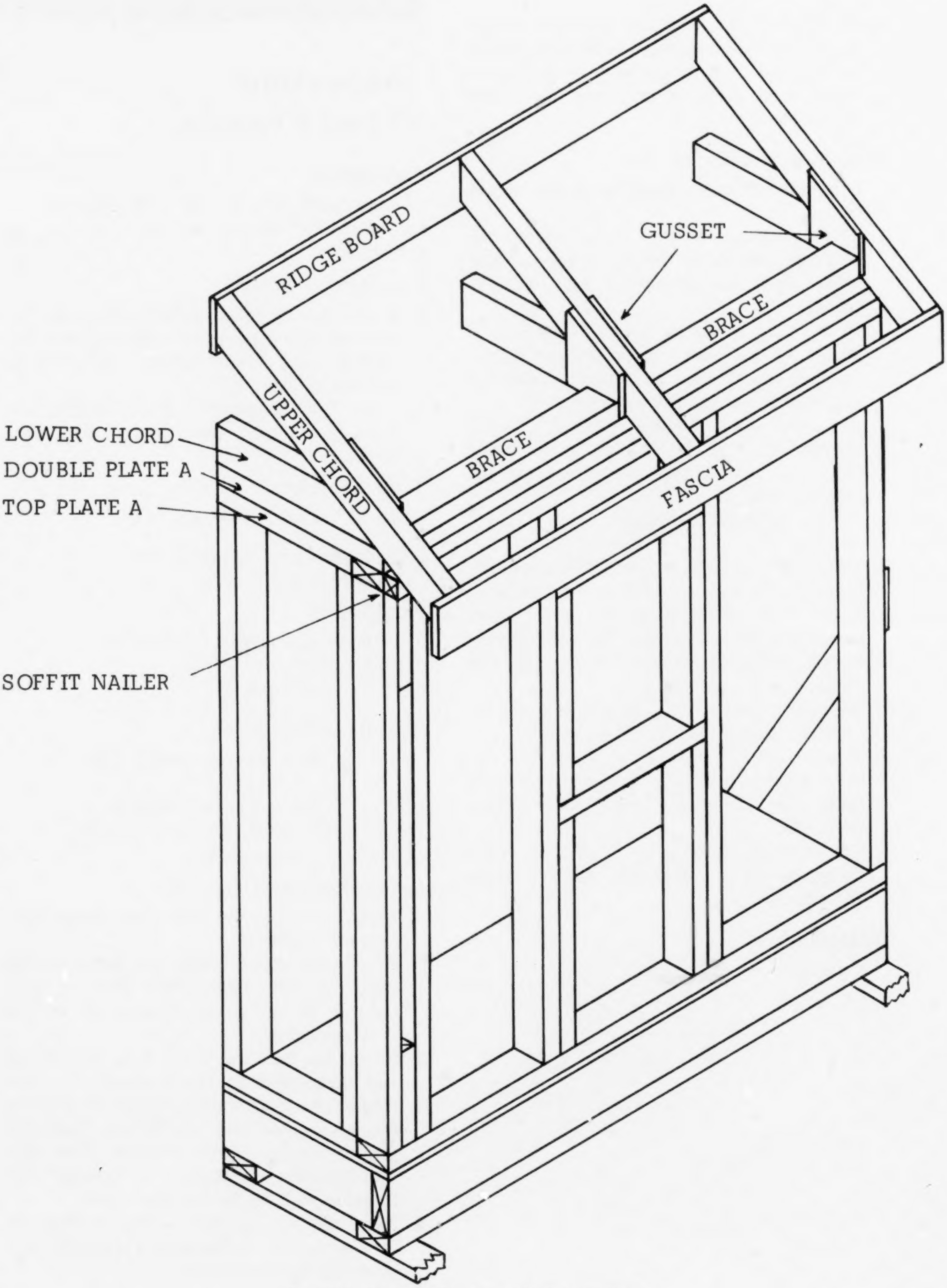

RIDGE BOARD
GUSSET
BRACE
UPPER CHORD
LOWER CHORD
DOUBLE PLATE A
TOP PLATE A
BRACE
FASCIA
SOFFIT NAILER

Fig. 89-1. Detail of Roof and Wall Assembly

9. Emphasize the need for accurate measurement in this activity. Ask the students to compare their measurements with your model roof truss before they saw their materials.

Laboratory Activity (25)

This activity may extend over the next 4 days.

1. Place your model roof truss where the students can easily use it for comparison with their measurements and calculations.
2. It will help if you have two T-bevels, adjusted to the exact angles of an upper and a lower chord. Use these to check the angles laid out by the students.
3. The instructor should rip all fascia boards (1″ x 6″ x 50″) at a 30° bevel along one edge before students begin installing them.
4. Assign groups to inspect each other's projects.
5. Have each student inspect the structure individually and record his own findings.
6. After each member of the group has completed his inspection, he will quietly gather with his group and discuss the inspection.
7. By group process, the group will decide whether to pass or fail the structure.
8. If a structure is rejected, have the inspection group meet with the group that built the structure and justify their decisions.
9. The ultimate decision as to whether anything should be changed remains with the teacher.

Homework

None

ASSIGNMENT 93

Inspecting Wood Frames

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the new Laboratory Manuals for the second semester, code the manuals for organization, identification, distribution, and collection.
2. Given the inspection checklist for the wood frame structure, correct any deficiencies.

Time Schedule

45 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment

5	framing squares
5	hammers
5	12′ steel tapes

Supplies (Per class)

25	2nd. semester Laboratory Manuals.
2 ea. (or more) of 1 color	felt markers in several different colors for each class period

Laboratory Activity (45)

1. Distribute the new second semester Laboratory Manuals.
2. Have each student sign his name on the cover of his Laboratory Manual and code it in the same manner as in the first semester.
3. Spend the balance of the time correcting any deficiences in the framing. For example, you may want to check the frames for squareness and plumb and have the groups realign their frames. This will facilitate the installation of exterior and interior wall surfacing materials.
4. Near the end of the period, collect the first semester Laboratory Manuals and store the new manuals.

Homework

Reading 48

ASSIGNMENT 94, UNIT 48

Installing Utilities

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to installing utilities:
   a. Name what utilities service your home and name other utilities which are used in your community.
   b. Describe some of the problems you would have if all the utilities you use were suddenly shut off.
   c. Describe some utility construction now going on near your home or school.

Discussion

2. Given the term "utility systems," define the concept.
3. Given the three common types of utility distribution networks—ducting, piping, and wiring:
   a. Point out examples of each in the school laboratory.
   b. Name other examples in homes.
4. Given that there are utility plants in their community or nearby, name some specific plants.

Time Schedule

5	Overview
10	Lecture
5	Discussion
25	Demonstration

Equipment and Supplies for Demonstration

Equipment

1	overhead projector/screen
1	framing square
1	awl
1 pr.	dividers
1	cold chisel
1 pr.	aviation snips *or* equiv.
1	pan brake *or* hand seamer
1	5/16″ hand groover
1	tinner's setting hammer *or* wooden mallet
1	center punch
1	slip roll, round stake, *or* 2″ dia. piece of pipe
1	hand *or* electric drill
1	⅛″ twist drill
1	screwdriver

Supplies

1	Transparency 94
1	No. 8 x ½″ sheet metal screw
1 roll	masking tape
1 set	28 gauge galv. sheet metal, cut as follows:
	1 pc. 4″ x 13½″ (cap)
	1 pc. 5″ x 27¾″ (boot)
	1 pc. 5″ x 13″ (duct)

Overview (5)

1. Your textbook reading explains that utilities provide essential services to structures and the people who use them.
2. I will show and tell you about utility systems between and within structures.
3. You will be asked questions about utility systems and will be expected to give examples of those found in your home and in our community.
4. I will demonstrate today the layout, cutting, and folding of sheet metal to form the ductwork that you will install in your structure.

Lecture (10)

1. Utilities are systems which distribute liquids (water, sewerage, oil), gases (natural gas, warm air, cooled air, filtered air), and electricity for power and communication (operating equipment, transmitting signals over wires and through air). Systems exist between and within structures.
2. Utility systems between structures distribute materials and energy from one structure to another. Water is pumped from a water treatment plant to a structure. Sewerage is drained from a structure for disposal. Natural gas is piped from the pumping station to structures. Electricity is carried over high-tension lines, sometimes with voltage as high as a million volts, to substations where the voltage is transformed for use in structures. Communications are sent over wires or through the air to be received by equipment in other structures.
3. As these materials and energy enter a structure, they may be changed or con-

verted into another form. Natural gas or oil is burned to warm or cool the air. Water is heated. Electricity is transformed to lower voltages, and signals are changed into messages. (Point out the boiler room, gas mains, and transformers in or near the school.)

4. These converted forms of materials and energy are then distributed within the structure to points of use. (Point out the following in the laboratory.) Plumbing lines carry water; ducts carry warm, cool and filtered air; and electrical lines carry energy to equipment, lights, and convenience outlets. We can think of the means for distributing these utilities as *ducting, piping,* and *wiring.*
5. Each system has a means of controlling the flow of materials and energy. (Point out the following in the laboratory.) Plumbing lines have valves and pumps; duct systems have thermostats, vents, and registers; and electrical wiring has switches.
6. For the next few days, we will be making and installing ducts for distributing air. We will then do some plumbing for distributing water and sewage. We will also do some electrical wiring to make a circuit for a light, a convenience outlet, and a switch.

Discussion (5)

The teacher should lead the students into a discussion, seeking to define and describe types of utilities. Several students should have an opportunity to respond to each question.

1. What are utility systems? (The distribution networks and equipment that furnish a service such as water, waste disposal, electrical power, fuel gas, or communication.)
2. In a home or a school there are three common types of utility distribution networks: ducting, piping, and wiring. Point out examples of these that you can see, or that you know are here in the laboratory. (Answers will vary.)
3. What kind of ducting, piping, or wiring might you have in your home that we do not have here? (Answers will vary.)
4. What utility plants do we have in our community or nearby? (Sewage treatment plant, telephone exchange, electrical power plant, water purifying plant, fuel-gas pumping station.)

Demonstration (25)

There are two main parts to this demonstration. The teacher should first make three component ductwork pieces and then fabricate a section of ductwork.

Making Component Pieces

1. Show Transparency 94, Fabricating Ductwork. Identify each of the duct parts: boot, cap, and duct. You will be fabricating these three pieces and assembling them into a ductwork section.
2. Caution students about the danger of sharp edges on sheet metal.
3. Label each demonstration piece (boot, cap, and duct) with appropriately marked masking tape.
4. Using an awl and a framing square, lay out and mark six fold lines on the boot piece as shown in Fig. 49A-1 in the Laboratory Manual. Also locate and mark the exact center of the piece.
5. With the dividers, scribe a 4″ diameter circle in the center of the rectangle.
6. Use a sharp cold chisel to puncture the metal inside the circle in order that aviation snips may be inserted.
7. Using aviation snips, cut out the circle.
8. Using the brake (or hand seamer) set at ¼″, bend each end of the boot, one end up and one end down. See Fig. 49A-2 in the Laboratory Manual.
9. Using either a brake, flat stake, wood block, or the edge of a table, bend the remaining four bends on the boot. See Fig. 49A-6 in the Laboratory Manual.
10. Lock the two ends of the boot together and use a hand groover to set the seam.
11. Using a setting hammer, hammer the seam down. With a center punch, lock it in the middle of the seam and about 1″ from each end. See Fig. 49-7A in the Laboratory Manual.
12. Using the awl, lay out and mark the boot cap as shown in Fig. 49A-2 in the Laboratory Manual. Cut out the corners with aviation snips.
13. Using a brake (or hand seamer) set at 15/16″, bend all four sides up 90°.
14. Using the awl, scribe a line ⅝″ from one edge. This line will be used in Activity 49 when making a dovetail joint. See Fig. 49A-3 in the Laboratory Manual.

15. With a brake or hand seamer set at 1/4", bend each end of the duct, one flap up and the other down.
16. Using either slip rolls, a round stake, or a piece of 2" diameter pipe locked in a vise, bend the metal into a cylinder. Be sure the scribed line is on the outside.
17. Lock, set, and hammer the seam as you did for the boot.
18. With a center punch, lock the seam in the center and about 1" from each end.

Fabricating Ductwork

1. Place the boot cap over the boot and scribe a line (freehand) where the cap covers the hole in the boot. See Fig. 49B-1 in the Laboratory Manual.
2. Cut out the arc just scribed on the flap of the cap.
3. Cut notches 1/2" apart down to the scratch mark on the duct to form tabs.
4. Starting at the seam, use the pliers to bend every other tab outward 90°. See Fig. 49B-3 in the Laboratory Manual.
5. Place the notched end of the duct into a hole in the boot.
6. Bend the tabs on the inside of the boot *down*. This is a dovetail joint. (Caution students about sharp edges.)
7. Fit the boot cap to the bottom of the boot. Remind students to be sure the arc cut on the flap fits around the duct properly.
8. Use the center punch to mark a hole about 2 1/2" from each end of each long flap, and in the center of each end flap. See Fig. 49B-6 in the Laboratory Manual.
9. Using a hand drill or electric drill and a 1/8" twist drill, drill a hole in *one* of the spots that have been center-punched on the flaps. Tell the students that they will drill a hole in *all* of the spots center-punched.
10. Install a No. 8 x 1/2" sheet metal screw in the hole through the cap and boot. Tighten the screw. Students will do this to all holes. Caution students that tightening screws too tight will strip them out.
11. Explain that the completed ductwork will be installed in the subfloor of the structure. Students are to follow directions in the Laboratory Manual for laying out and cutting an opening in the subfloor.
12. *Emphasize* that students should *not* drill holes in the subfloor until you have checked their layout.

Safety Precaution

Caution the students to handle sheet metal carefully. The edges are sharp.

Homework

Reading 49

ASSIGNMENT 95, UNIT 49A

Installing Heating, Cooling, and Ventilating Systems

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to installing heating, cooling, and ventilating systems:
   a. State four ways in which air can be changed or "treated."
   b. Name several devices that control temperature, humidity, or the flow of air in a room.
   c. Give reasons why it might be easier to install ductwork before plumbing or wiring.

Discussion

2. Given the names of several devices and functions concerning heating, cooling, and ventilating systems, associate each device and each function with treating air, circulating air, or controlling some part of the system.

Laboratory Activity

3. Given the equipment, supplies, and instructions:
   a. Lay out, cut, and bend three pieces of sheet metal to form a boot, boot cap, and round duct.
   b. Fasten together the ends of a formed duct, and fasten together the ends of a formed boot with seam joints.

Time Schedule

5	Overview
5	Discussion
35	Laboratory Activity

Equipment and Supplies for Discussion

Equipment

1	overhead projector/screen

Supplies

1	Transparency 95

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	framing square
1	awl
1 pr.	dividers
1	cold chisel
1 pr.	aviation snips *or* equiv.
1	pan brake *or* hand seamer
1	tinner's setting hammer *or* wooden mallet
1	5/16″ hand groover
1	center punch
1	slip roll, round stake, *or* 2″ dia. of pipe

Supplies (Group of 5)

1 set	28 gauge sheet metal pcs., cut as follows: 1 pc. 5″ x 27¾″ (boot) 1 pc. 4″ x 13½″ (cap) 1 pc. 5″ x 13″ (duct) 1 pc. 2″ x 4″ x 12″ scrap softwood
1 roll	masking tape

Overview (5)

1. Your text reading explains how heating, cooling, and ventilating systems provide a comfortable climate within structures.
2. I will show a transparency listing several devices and functions which you will be asked to relate to either *treating* air, *circulating* air, or *controlling* some part of the system.
3. In the laboratory activity, you will begin fabricating the ductwork that will be installed in your structure.

Discussion (5)

Use Transparency 95 to review the text reading.

1. Show Transparency 95, Classifying Air Treatment, Circulation, and Control Functions. Which terms on this list name functions or processes for *treating* air? (Heating, purifying, cooling, humidifying.)
2. Which terms name *circulating* functions? (Supplying, exhausting, returning.)
3. Which terms name *control devices*? (Damper, thermostat, humidistat.)
4. See Fig. 95-1, Key to Transparency 95.

Device or Function	Treating Air	Circulating Air	Control Devices
Heating	X		
Damper			X
Purifying	X		
Thermostat			X
Supplying		X	
Exhausting		X	
Returning		X	
Humidistat			X
Cooling	X		
Humidifying	X		

Fig. 95-1. Key to Transparency 95

Laboratory Activity (35)

Today students will form the three ductwork pieces: boot, cap, and duct.

1. Have students turn to Activity 49A and read the directions.
2. Review with the students what today's activity will include. In the interest of time, it is suggested that each group divide up the tasks as follows: after the students have prepared for work (Steps 1, 2), two students can make the boot (Steps 3-10), one student can make the boot cap (Steps 11-13), and two students can make the duct (Steps 14-18).
3. Give individual instruction as necessary.
4. Before the end of the period, have students clean up the work area and return all equipment and supplies.
5. Instruct students about storing the ductwork. It will be used in Activity 49B.

Safety Precaution

Handle *all* sheet metal carefully. All edges are sharp.

Homework

None

ASSIGNMENT 96, UNIT 49B

Installing Heating, Cooling, and Ventilating Systems

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a sheet metal boot, boot cap, and round duct, assemble the ductwork with a dovetail joint and sheet metal screws.
2. Given a sheet metal boot assembly and structure,
    a. Lay out the location of the duct opening on the subfloor.
    b. Saw out the subfloor opening.
    c. Install the ductwork in the structure.

Time Schedule

5 Overview
40 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1 pr.	aviation snips
1 pr.	pliers
1	electric drill *or* hand drill
1	⅛″ twist drill
1	screwdriver
1	awl
1	try square
1	brace
1	No. 8 (½″) auger bit
1	compass saw *or* sabre saw
1	claw hammer
1	center punch

Supplies (Group of 5)

6	No. 8 x ½″ sheet metal screws
2	6d box nails
1 ea.	boot, boot cap, and duct from Activity 49A

Overview (5)

1. Yesterday you began fabricating ductwork for your structure.

2. Today you will complete the ductwork and install it.

Laboratory Activity (40)

Today each group of students will assemble and install a ductwork section. (Note: If Activity 49A was not completed, use the beginning of this period to finish the work.)

1. Have each group of five students divide up the work as follows: three students assemble the duct, boot, and cap (Problem 1), while two other students prepare for installation (Problem 2, first part).
2. Have students read the directions for their assigned problem, and answer any questions they may have.
3. Students who do Problem 2 will be using a brace and bit. Give individual guidance in this task as necessary.
4. Be sure that students working on Problem 2 have you check their layout before they begin to bore holes.
5. Before the end of the period, have students clean up the work area and return all equipment and supplies.

Safety Precaution

Handle all sheet metal carefully as all edges are sharp.

Homework

Reading 50

ASSIGNMENT 97, UNIT 50

Installing Plumbing Systems

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to installing plumbing systems:
    a. Name two separate piping systems required for most structures.
    b. List four materials carried through plumbing systems.
    c. Name the person whose trade or craft has prepared him to install piping systems in your home.

Laboratory Activity

2. Given a steel tape and try square, lay out the locations for plumbing lines on a structure.
3. Given a brace and bit, bore holes for installing plumbing lines.
4. Given galvanized pipe and a pipe cutter, cut pipe to length.
5. Given a pipe die and stock, cut threads on galvanized pipe.
6. Given pipe wrenches, pipe, and fittings, assemble the pipe and fittings.

Time Schedule

5	Overview
15	Demonstration
25	Laboratory Activity

Equipment and Supplies for Demonstration

The instructor will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	steel tape
1	try square
1	brace w/No. 16 (1") auger bit
1	pipe vise

1	pipe cutter
1	round file
1	½″ pipe die and stock
1	pipe reamer
1	10″ pipe wrench

Supplies (Group of 5)

1	wood frame wall section
1 pc.	*½″ x 36″ galvanized pipe (to be cut into 14″, 12″ and two 5″ pieces)
2	½″ 90° galvanized elbows (1 plain, 1 drop-eared)
1 can	cutting oil
1	pipe-dope applicator brush
1 pc.	cloth or rag
1 can	(empty: to catch cuttings and oil)

* See Laboratory Activity Note A.

Overview (5)

1. You have read that *plumbing systems* provide a means for moving hot and cold water, gas, steam, and other fluids.
2. You also read that other systems of piping carry all liquid wastes away from our buildings and streets. These systems we call *sanitary sewerage* and *storm sewerage.*
3. Today I will show you how a structure is prepared for installing the plumbing lines and how pipe is cut and threaded for use in plumbing a structure.
4. Following the demonstrations, some of you will prepare your structure to receive piping, and others will be involved in cutting and threading the pipe.

Demonstration (15)

Part I of this demonstration should take about 5 minutes, and Part II should take about 10 minutes.

Part I: Laying Out and Boring Holes

1. Follow the procedures shown in Figs. 97-1, 97-2, 97-3. Using a steel tape and a try square, demonstrate how to locate on a sole plate the centers of the holes for the plumbing pipes.
2. Review how to insert a bit in a brace and the proper use of a rachet brace.
   Note: *Do not* bore the hole for the drain line.

Part II: Cutting Pipe, Threading, and Attaching Fittings

1. Arrange the needed equipment and supplies on a bench before class.
2. Explain that a system which circulates compressed air, gas, or water must withstand a great deal of pressure and, therefore, is constructed from piping rather than ductwork.
3. Place a 36″ length of pipe in the pipe vise with approximately 18″ extending. Explain what you are doing as you work.
4. Lay off 14″ on the pipe. Using a pipe cutter, cut a 14″ length.
5. Place the 14″ piece of pipe in the vise with approximately 6″ extending.
6. Ream out any burrs left by the pipe cutter. Do not expand the pipe.
7. Cut the threads so that two threads ex-

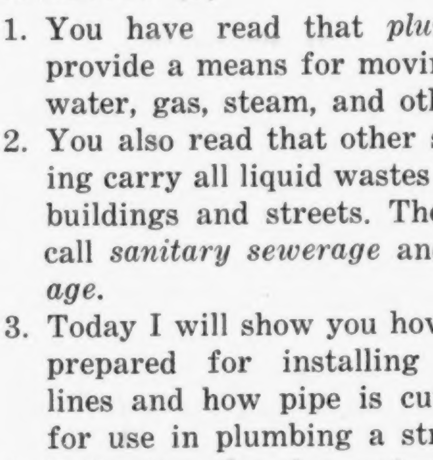


Fig. 97-1. Measuring for Pipes

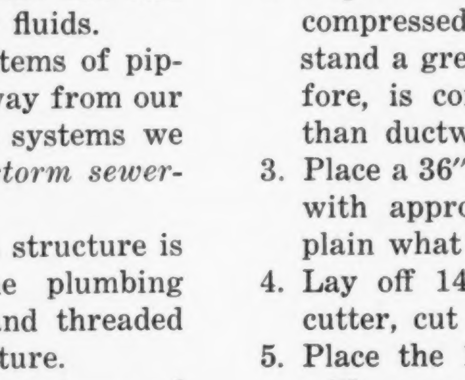


Fig. 97-2. Marking the Sole Plate

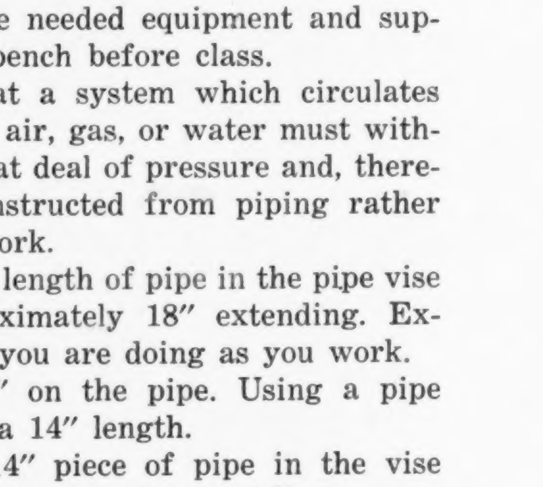


Fig. 97-3. Locating Hole Centers

tend past the die face. Use cutting oil as needed.

8. Using a pipe wrench, tighten the 90° elbow on one end of the threaded pipe. Use pipe dope on the pipe thread.

Laboratory Activity (25)

Note A: In subsequent years, only 10″ of new pipe is needed per group. The 10″ lengths can be converted to nipples to provide experience in layout, cutting, reaming, and threading.

1. In today's activity the students will prepare, assemble, and install part of the plumbing system. Assign two students in each group to do Problem 1, and three students to do Problem 2.
   Note B: If students working on Problem 1 finish early, it is suggested that you have them begin Problem 2 of Activity 51. They will be preparing the backing board and backing board blocks for later installation.
2. Call attention to the positions of the hot and cold water lines (Laboratory Manual Fig. 50-1). Explain that when we install fresh water pipes for a sink or wash basin, the cold water line goes on the *user's* right, the hot water line goes on the left, and the waste pipe goes in the center. Note: the 5″ nipples will be inserted in the drop-eared elbows.
3. Give individual help as needed.

Safety Precaution

Whenever metal is being cut or threaded in any way, care must be taken to avoid being cut by the sharp edges or cuttings.

Homework

Reading 51

ASSIGNMENT 98, UNIT 51A

Installing Piping Systems

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to installing piping systems:
   a. Compare and contrast *plumbing* systems to pipeline systems.
   b. Name two pipeline systems in your community, one above ground and the other below ground, and give the purpose of each.

Laboratory Activity

2. Given the necessary equipment and supplies:
   a. Cut and ream copper tubing.
   b. Flux, assemble, and sweat-solder copper tubing and fittings.
3. Given the necessary equipment and supplies and a structure:
   a. Measure the distance between studs.
   b. Lay out and cut a backing board and nailer.
   c. Install the backing board and nailer.
4. Given the equipment, supplies, and partially installed copper tubing and galvanized pipe assemblies, secure the tubing assembly and the pipe assembly to the backing board.

Time Schedule

5	Overview
20	Demonstration
20	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	bench vise
1	tube cutter with reamer
1	propane torch (small tip)
1	striker (for torch)
1	steel tape
1 pc.	transite *or* several firebrick

Supplies

1 pc.	½″ Type L, hard copper tubing (to be cut 14 inches long) *
1	½″ copper x ½″ F.I.P. drop-eared elbow
1 roll	50-50 solder
1 can	soldering flux
1 pad	steel wool
1	cloth or rag
1	½″ galv. pipe nipple from Activity 50

* See Laboratory Activity Note.

Equipment and Supplies for Laboratory Activity

Problem 1 (3 students)

Equipment

1	steel tape
1	bench vise
1	tube cutter with reamer
1	propane torch (small tip)
1	striker (for torch)
1 pc.	Transite *or* several firebrick

Supplies

1 pc.	½″ Type L, hard copper tubing (to be cut 14″ long) *
1	½″ copper x ½″ F.I.P. drop-eared elbow
1	½″ galv. nipple (from Activity 50)
1 roll	50-50 solder
1 can	soldering flux w/brush
1 pad	steel wool
1	cloth or rag

* See Laboratory Activity Note.

Problem 2 (2 students)

Equipment

1	screwdriver
1	steel tape
1	claw hammer
1	crosscut saw

Supplies

8	6d box nails
2 pcs.	1″ x 1″ x 8″ wood
1 pc.	1″ x 6″ board (to be cut to fit between studs)
4	No. 8 x ¾″ flat head screws
1	½″ pipe clamp
1 pc.	2″ x 4″ x 12″ wood (nailer)
3 lb.	16d common nails

Overview (5)

1. In your reading you learned that "pipelines" are piping systems, usually located underground, that run *outside* of buildings to bring water and other fluids to structures and carry away liquid wastes. We are not equipped to perform piping activities; therefore, we will continue with plumbing our structures.
2. I will show you how to cut tubing, how to use a propane torch, and how to sweat-solder a copper tubing joint.
3. In the laboratory activity, some of you will sweat-solder the copper tubing joint. Others will install a nailer and the backing board to which the hot water and cold water lines will be fastened.

Demonstration (20)

During today's activity, students will be asked to assemble, light, and extinguish a propane torch. Therefore, the second part of this three-part demonstration concerns the safe use and handling of a torch.

Part I: Cutting Tubing

1. Arrange the necessary equipment and supplies on a bench before class. Unless a demonstration bench is provided in front of the class, use a different bench than that used in the pipe demonstration.
2. Explain that you will now demonstrate how to cut tubing.
3. Cut a 14″ length of tubing.
4. Using the reamer on the end of the tube cutter, remove burrs from the inside of the tube end. Be careful not to expand the tubing.

Part II: Using a Propane Torch

1. Point out the parts of the torch: (a) tank of fuel, (b) burner unit, (c) blowtorch head, (d) flame spreader, and (e) a spark lighter.
2. Demonstrate assembling.
    a. Check to be sure the valve is fully closed by turning the valve knob clockwise.
    b. Thread the burner unit with blowtorch head onto the top of the fuel tank. Turn the burner unit clockwise until it is sealed, hand-tight, into the cylinder. Do not use a wrench or other tool to tighten.
    c. When the flame spreader is to be used, it should be placed over the

blowtorch head and hand-tightened into place.

3. Demonstrate lighting.
   a. Open the control valve only until a low hiss of escaping gas can be heard. Ignite the escaping gas with a spark lighter.
   b. Allow the burner to get hot before opening the control valve further.
   c. Adjust the burner flame with the control valve for best efficiency.
4. Demonstrate extinguishing.
   a. Close the control valve fully.
   b. When the burner unit is cool enough to handle, unthread it from the fuel tank.

Part III: Sweat-Soldering

1. Using steel wool, carefully clean approximately 1″ on one end of the tubing, and clean the inside of the drop-eared elbow.
2. Flux the cleaned end of the tubing and the cleaned opening in the fitting.
3. Push the fitting onto the end of the tubing. Turn the fitting one complete revolution to make certain that the flux is evenly spread.
4. Clamp the tubing horizontally in a vise, with the open end of the fitting pointing upward. Place a piece of Transite under the assembly.
5. Light the torch with the striker. Move the flame of the torch around the fitting and tube until the flux begins to boil. Start feeding the solder. It will be drawn to the hottest area, so be certain to direct the flame where you want the solder to flow. When the solder starts to drip, the joint is full.
6. Stress safety factors throughout the demonstration.

Laboratory Activity (20)

For this activity each group will be divided into two subgroups. Three students will cut and sweat-solder the tubing assembly (Problem 1). Two students will measure, cut, and install the backing board and nailer (Problem 2).

Note: If you plan to use the same tubing next year, you should add about 4″ of length to each tube for cutoff purposes. If this is done, adjustments need to be made in the location of the backing board.

1. Explain to your students that Activity 51 will be started today and completed during the next class period.
2. Explain the subgroup assignments.
3. Move from group to group, answering questions and giving help as needed.

Safety Precaution

Avoid being burned! Be careful lighting and using the torch. Do not touch hot materials unless you are wearing safety gloves.

Homework

None

ASSIGNMENT 99, UNIT 51B

Installing Piping Systems

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given samples of several piping materials not used in the laboratory activity (e.g., cast iron pipe, plastic pipe, clay soil pipe), identify each material and state ways in which each might be used.

Laboratory Activity

2. Given the necessary equipment and supplies, complete the installation of hot water and cold water lines in their structure.

Time Schedule

5 Overview
10 Lecture-Discussion
30 Laboratory Activity

Equipment and Supplies for Lecture-Discussion

Supplies

Samples of all available piping materials. For example:

2′	cast iron soil pipe
1′	clay soil pipe
2′	plastic pipe

Equipment and Supplies for Laboratory Activity

All equipment and supplies will be the same as those listed for Activities 50 and/or 51A.

Overview (5)

1. In Readings 50 and 51, you learned about several kinds of piping materials. Some of these are quite different from the galvanized pipe and copper tubing which you have used.
2. I will show you some of these materials, and we will discuss ways of using several piping materials.
3. You will be asked to identify these materials and to name ways in which each might be used.
4. After you complete your laboratory activity, you will have a chance to examine these samples more closely.

Lecture-Discussion (10)

Note: Each teacher will need to adapt his lecture according to the variety of piping materials he has been able to obtain.

1. Show each material, identify it, and give an example of its application.
2. Show each material, have student identify it, and give examples of its use.

Laboratory Activity (30)

This day is set aside to give each group an opportunity to complete all plumbing installation.

1. Instruct students to check Laboratory Activities 50 and 51A and B, making sure that all tasks are completed today.
2. The last class may assist in storing equipment used only for plumbing activities.

Homework

Reading 52

ASSIGNMENT 100, UNIT 52

Installing Electrical Power Systems

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to installing electrical power systems:
   - a. Describe some differences between *outside and inside construction* electrical power systems.
   - b. Trace the *outside electrical construction* from power plant, transformers, distribution lines, and drop line to your home.
   - c. Locate the three main elements of *inside electrical construction* in your home: entrance, distribution panel, and branch circuits.

Laboratory Activity

2. Given the necessary equipment and supplies,
   - a. Lay out the wiring run for the electrical wiring system.
   - b. Drill holes as marked for the electrical system, following safe and proper procedures.
   - c. Install electrical outlet boxes.

Time Schedule

5	Overview
10	Demonstration
30	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	electric drill
1	7/8" speed bit
1	steel tape
1	screwdriver
1	try square
1	claw hammer

Supplies

1 pc.	2" x 4" x 12" scrap lumber
1	light fixture box
1	adjustable bar hanger
1	switch box
2	16d nails
2	No. 8 x 1/2" pan head sheet metal screws
4	6d nails

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	steel tape
1	try square
1	electric drill
1	7/8" speed bit
1	screwdriver
1 pr.	6" slip-joint pliers
1	claw hammer

Supplies (Group of 5)

1	black lumber crayon
1	octagon outlet box w/loom clamps
1	adjustable bar hanger
1	conduit duplex outlet box w/side knockout
1	switch box w/loom clamps and bracket
2	16d nails
4	6d nails
4	No. 8 x 1/2" pan head sheet metal screws
1	3/4" x 4" board approx. 30" long (for locating bar hanger)

Overview (5)

1. Your text reading described an electrical power system. You read about how electricity is *generated* at a power plant, *distributed* through outside electrical wiring or cable, and *delivered* through inside wiring to operate your appliances and fixtures.
2. I will demonstrate how a structure is prepared for wiring.
3. During the laboratory activity you will lay out and drill holes for the wiring run, and you will attach electrical outlet boxes.

Demonstration (10)

1. Demonstrate how to lay out the wiring run (location of outlets). This shows where the outlets will be located on the walls and ceiling.
2. Demonstrate how the hole centers are marked for drilling.

3. Demonstrate how to assemble and use an electric drill and speed bit safely.
4. Demonstrate how the light fixture box (octagon outlet box) is attached to the joist using an adjustable bar hanger.
5. Demonstrate how a switch box is attached to a stud.
6. Emphasize the correct installation of electrical boxes, allowing for the thickness of the finish wall or ceiling. For example, where 3/8″ drywall is to be used, the box should project 3/8″ from the stud; but if 1/2″ drywall is used, the box should project 1/2″. Where paneling or tile will be applied on top of drywall, the box placement should allow for this.

   Note: Before students begin installing the outlet boxes in their frame structures, the teacher *must* know the thickness of all wall materials to be used and instruct his students accordingly. Look ahead to "Applying Wall Materials," (Assignments 116-119, Activities 61A-61D,) and choose from among the suggested alternatives.

Laboratory Activity (30)

1. Students are to work in their assigned groups of five.
2. Students should share the tasks of laying out and boring the holes and installing the outlet boxes.
3. When a student is not actually involved in performing a task, he should observe the work.

Safety Precautions

1. Be sure the speed bit is tight in the drill chuck.
2. Be sure the chuck key is removed from the chuck.
3. Wear goggles to protect your eyes when drilling or when standing near where others are drilling.
4. Drill *away* from your body.
5. Keep both hands away from the revolving bit.

Homework

Reading 53

ASSIGNMENT 101, UNIT 53

Installing Electrical Communications Systems

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to installing electrical communication systems:
   a. Name the communications systems you have in your home and state whether or not you have both transmitting and receiving devices.
   b. Indicate how far away the nearest television station is from your home and indicate if the transmitter is located at the station or elsewhere.

Laboratory Activity

2. Given the necessary equipment and supplies, prepare and install thinwall conduit, flexible armored cable, and nonmetallic sheathed cable in a structure.

Time Schedule

5 Overview
15 Demonstration
25 Laboratory Activity

Equipment and Supplies for Demonstration

The teacher will use the equipment and supplies needed for one group of students, to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Problem 1 (Group of 5)

Equipment

1	1/2″ conduit bender
1 pr.	6″ slip-joint pliers
1	hacksaw
1	round file *or* pipe reamer
1	brace, if pipe reamer is used
1	screwdriver
1	steel tape

Supplies

1 pc. ½″ thinwall conduit (EMT) to be sawed to 37″ length
1 ½″ EMT box connector
1 ½″ EMT hanger
1 No. 8 x ¾″ flat head screw

Problem 2 (Group of 5)

Equipment

1 fish tape
1 pr. 6″ slip-joint pliers

Supplies

1 6′ length No. 12 T.W. wire, white*
1 6′ length No. 12 T.W. wire, black*
1 6′ length No. 12 T.W. wire, green*

Problem 3 (Group of 5)

Equipment

1 steel tape
1 claw hammer
1 hacksaw

Supplies

1 5′ length No. 12/2 w/ground flexible armored cable (BX)*
2 armored cable (BX) box connectors (for ⅜″ cable)
2 insulating bushings (for ⅜″ BX)
2 ⅜″ armored cable staples

Problem 4 (Group of 5)

Equipment

1 claw hammer
1 cable ripper
1 electrician's knife
1 screwdriver

Supplies

1 6′ length No. 12/2 w/ground nonmetallic sheathed cable (ROMEX)*
2 ROMEX staples

* See Laboratory Activity Note

Overview (5)

1. Your reading described some electrical communication systems that span great distances and others that have been developed for use within a structure or on a site. Some of these communication systems are public; others are for private use.
2. I will show you how to prepare and install three types of wiring used within structures, using several special tools and materials.
3. In the laboratory activity, you will use these same tools and materials to do the rough wiring work on your structures.

Demonstration (15)

Today the students will begin the rough wiring work in their structures. Several short demonstrations will be required to supplement the directions given in the Laboratory Manual. (Note: You may prefer to subdivide each group for this activity, so that only two or three students in each group work with one or the other types of wiring. However, it is strongly recommended that *all* students observe the special techniques that each of the materials require.)

1. A suggested sequence for the demonstrations is given here. As you start each demonstration, name and call attention to the tools, the kinds of wiring, and the fittings.
   a. Cut, measure, and bend the conduit.
   b. Cut and remove armor from armored cable (BX).
   c. Cut and rip the nonmetallic sheathing from the Romex.
   d. Remove the knockout from an outlet box, and insert and tighten the box connectors.
   e. Install an insulating bushing in BX.
   f. Pull and secure wires and cables.
2. A number of electrical terms are used in this activity. Students may find it helpful to have this information available on the chalkboard:

   T.W. Wire: *T*hermoplastic-*W*eatherproof *W*ire. The insulation on this wire makes it weatherproof. T.W. wire is made in single strands.

   EMT: *E*lectrical *M*etal *T*ubing. A tubing with thin walls, through which wire is led. It is also called *thinwall conduit.*

   ROMEX: Nonmetallic sheathed cable of an early type. It was first made by the Rome Wire Co. Romex wire may have two or more T.W. wires within the sheathing.

   BX: A newer, armored "bushed" cable. It is different from the Romex, but also contains two or more T.W. wires.

Laboratory Activity (25)

Note: If you plan to use the electrical wires again next year, you should add about 1′ of length to each wire for cutoff purposes. A loop can be made in the wire to take up the slack.

1. Today the students will prepare and install thinwall conduit (Problem 1), T.W. wire (Problem 2), flexible armored cable (Problem 3), and nonmetallic sheathed cable (Problem 4).
2. The students may work in groups of five, or you may subdivide them so that fewer students work on each problem.
3. Move around the room to answer questions and give help with individual problems.
4. Some additional time is provided in the next assignment to complete the wiring.

Safety Precautions

1. When using a hacksaw—
   a. To avoid getting metal particles in your eyes, wear goggles.
   b. To avoid cutting yourself with a broken blade, use the saw carefully.
2. Never touch a sharp edge or point on cut metal.
3. Avoid puncturing your skin, or anyone else's, with the ends of wires.

Homework

Reading 54

Note: See Assignment 102 (Lecture-Demonstration) for preparation of inspection cards.

ASSIGNMENT 102, UNIT 54

Making Inspections

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to making inspections:
   a. Give reasons why inspections are made at the construction site and state when they are made.
   b. Give reasons why building codes are important to the local inspector and why he should be familiar with these codes.

Laboratory Activity

2. Given the necessary equipment and supplies, complete the rough wiring of a structure.
3. Given a steel tape, wire gauge, and checklists:
   a. Inspect the rough wiring in a structure, and note corrections needed.
   b. Inspect the plumbing in a structure, and note corrections needed.

Time Schedule

5	Overview
10	Lecture-Demonstration
30	Laboratory Activity

Equipment and Supplies for Lecture-Demonstration

The teacher will use the equipment and supplies needed for one group of students to demonstrate the procedures they will follow, plus one local building inspection card.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

For completing rough wiring, see Activity 52 or 53 equipment list.

For making inspections:

1	steel tape
1	wire gauge, American *or* Brown and Sharpe

Supplies (Group of 5)

For completing rough wiring, see Activity 52 or 53 supply list.

For making inspections:

2	3″ x 5″ index cards *or*
1	local building inspection card
2	thumbtacks

Overview (5)

1. In your reading assignment, you learned (a) that inspections are made throughout the planning and construction of a building by many different people and (b) that inspections are made to find out whether proper construction techniques have been followed and whether the quality of material and workmanship comes up to established standards.
2. I will show you how an inspector might examine your structure and indicate what changes he would require before permitting work to proceed.
3. In the laboratory today you will be expected to accomplish two things:
   a. You are to complete the rough wiring of your structure.
   b. Each group is to inspect another group's structure.

Lecture-Demonstration (10)

(**Note:** You may want to have inspection cards printed in advance so they are ready for use today. See Fig. 102-1. Or you may have the foreman of each group prepare two cards.)

1. Explain that "inspect" means "look at closely" or "officially examine" something.
2. To help an inspector remember all he is to look for, and to give him a means of reporting what he has found, he works with a checklist.
3. Inspections are made by many people and organizations.
   a. Some have a financial interest in the work being done. This group includes owners, insurance companies, and loan agencies.
   b. Some are working in the construction field (for example, architects, engineers, and contractors) and must protect their reputation for high quality work.
4. Today you will inspect the electrical work and the plumbing if time permits. You will work from a checklist of items to be examined and record your findings on an inspection card. (Show a sample inspection card and demonstrate how it is to be completed.)

Laboratory Activity (30)

1. Students will work in their usual groups. During the first 15-20 minutes, they are to complete their rough wiring.
2. When all wiring is complete assign each group a structure *other* than their own. They are to spend the final 10 to 15 minutes inspecting the wiring and (if time permits) the plumbing installations.

Homework

Reading 55

INSPECTION CARD FOR STRUCTURE NO. ________

Electrical ______] Check one. Passed ______] Check one.
Plumbing ______] Rejected ______]

Correction needed (if any): ______________________

____

____

____
(Date) Signed (Group Foreman)

Fig. 102-1. Inspection Card

Mediating and Arbitrating

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to mediating and arbitrating:
   a. Define the difference between mediation and arbitration.
   b. Give a reason why the process of arbitration is rarely used in the construction industry.

Laboratory Activity

2. Given a jurisdictional dispute (hypothetical) involving two crafts, participate as a mediator, an arbitrator, or a union representative.

Time Schedule

5 Overview
10 Lecture
30 Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1	overhead projector/screen

Supplies

1	Transparency 103

Overview (5)

1. Your text reading explained mediation and arbitration.
   a. Mediation or arbitration may be used to avoid a work stoppage.
   b. A mediator makes recommendations and proposes solutions.
   c. An arbitrator makes decisions that are binding.
2. I will tell you more about mediation and arbitration and explain a jurisdictional dispute.
3. In the laboratory activity, you will discuss the issues in a jurisdictional dispute and participate as an arbitrator, a mediator, or a union representative.

Lecture (10)

A number of technical terms and concepts occur in today's lesson. Transparency 103 is a list of terms and definitions. It is paraphrased here with suggestions for further explanation and interpretation.

1. Show Transparency 103, Terms to Know. A *mediator* is a neutral outsider—or a group of outsiders—called upon to make suggestions and propose solutions to a dispute.
2. An *arbitrator* is a neutral outsider—or group of outsiders—called upon to make *binding* decisions in a dispute. (Point out how the job of a mediator differs from the job of an arbitrator.)
3. A *jurisdictional dispute* is a disagreement between two unions or crafts as to which one has a specific legal right to power. (In Reading 55 students read about a typical jurisdictional dispute. You may review the details of that example. Today's Laboratory Activity also will concern a jurisdictional dispute.)
4. A *brief* is a written statement of the issues in a dispute. An arbitrator must study the brief to become familiar with a case.
5. A *hearing* is a special kind of meeting. People who represent each side in a dispute or disagreement are asked to speak. At an arbitration hearing, the arbitrator "hears" or listens to all the arguments that relate to the dispute.
6. In a jurisdictional dispute, the arbitrator's decision is called an *award.* As he prepares the award, he keeps in mind the following requirements:
   a. Nothing should be said about issues not at stake.
   b. All the issues that are submitted for arbitration must be settled.
   c. The award must be enforceable.

Laboratory Activity (30)

1. Select three students to act as plumbers and three to act as carpenters. They will present arguments in a dispute about their structures.
2. Arrange the room so that all the students can observe the activity. If possible, provide a conference table for the six representatives.
3. Explain that the issue is a jurisdictional dispute between the (*school*) Junior High School Plumbers' Union and the

(*school*) Junior High School Carpenters' Union. Each union feels that its members should be responsible for installing the backing board for the plumbing in future structures.

4. Spend about 5 minutes discussing with the class why each side would want to install the backing board and what importance it would have. Let the students initiate the discussion as much as possible. (If discussion lags, you might ask how working hours, wages, etc. might be affected by the decision.)
5. When you feel that enough points have been presented, select three students to represent plumbers and three to represent carpenters. Have them move to the table.
6. Instruct the rest of the class that each of them is now a mediator. They are to listen as each side presents its case. Tell them that after the union representatives discuss the dispute, you will call on several mediators to suggest a solution as a real mediator would.
7. Allow 5 to 10 minutes for the union representatives to give reasons why their union should install the backing board. Then ask several mediators what recommendations they would make.
8. Explain that a mediator has no power to enforce decisions and that if a dispute still exists after mediation, both sides can *voluntarily* agree to enter arbitration.
9. Indicate to the students that a dispute still exists (or could exist) and that there will now be an arbitration "hearing" at the request of both unions.
10. Select six new representatives to discuss the dispute at an arbitration hearing. The rest of the class will now be individual arbitrators. Explain that *all* of them will be asked to make a decision after the hearing.
11. When the hearing is completed, have students turn to Activity 55 in the Laboratory Manual and complete the chart.
12. Emphasize to the students that both sides must go along with the decision of an arbitrator. You could ask for a show of hands to see how many agree with the plumbers and how many agree with the carpenters.

Homework

Review of Readings 47 to 55. If Review Assignment 104 (optional) is used, have students bring their textbooks to class. If the review is not used, have students study for the test.

ASSIGNMENT 104, UNITS 47-55 (OPTIONAL)

Review 47–55

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given the summaries of Readings 47 through 55, ask and answer questions about building wood frames; installing heating, cooling, and ventilating systems; installing plumbing and piping systems; installing electrical power and communication systems; making inspections; and mediating and arbitrating.

Time Schedule

45 Discussion or Laboratory Activity

Discussion or Laboratory Activity (45)

This review time can be used in various ways. Plan to follow one of the following alternatives.

Alternatives:

1. Students can play the "Big Builder' game to become more familiar with the concepts and processes of construction.
2. Pose the questions and situations at the end of each reading to stimulate thinking and discussion.
3. Have each "group" of students get together and list two or three words or concepts they would like to have explained or discussed. Discuss and clarify the concepts.
4. Ask a guest speaker, knowledgeable about installing utilities to talk to the class. Schedule the speaker for the first class period and tape record his talk so it can be played to your other classes.
5. Schedule a field trip to a construction site where utilities are being installed.

Homework

None

ASSIGNMENT 105

Test No. 6

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given Test No. 6, select the correct responses from a list of items related to concepts presented in Readings 47 through 55.

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

1. Seat the students to best advantage for administering a test.
2. Distribute pencils and erasers.
3. Distribute answer sheets and have students fill out needed information.
4. Pass out test booklets. "Keep closed until I say to begin."
5. Read directions for filling in answers. Open test booklets and begin.
6. Allow 35 minutes for completion. Collect answer sheets first, then test booklets.
7. Review the test with students to provide feedback.

Homework

Reading 56

Answers for Test No. 6

1. D	2. B	3. A	4. C	5. B	6. C	7. B	8. A	9. B
10. C	11. A	12. C	13. A	14. B	15. A	16. D	17. A	18. C
19. D	20. D	21. D	22. A	23. D	24. A	25. B	26. C	27. B
28. C	29. D	30. A	31. B	32. A	33. A	34. D	35. C	

ASSIGNMENT 106, UNIT 56

Enclosing Framed Superstructures

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to enclosing framed superstructures:
    a. Name the kinds of exterior materials used to enclose your school.
    b. Identify the materials that enclose the frame or bearing walls of your industrial arts laboratory.

Laboratory Activity

2. Given the necessary equipment and supplies, prepare and install the wall sheathing on their structures.

Time Schedule

5 Overview
10 Demonstration
30 Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	chalkline
1	steel tape
1	brace w/No. 16 (1″) auger bit

Supplies

1 pc.	½″ x 48″ x 56″ sheathing material. (Use material that is economical and suitable for your geographic area.)

Equipment and Supplies for Laboratory Activity

Problem 1 (3 students)

Equipment

1	compass saw
1	brace w/No. 12 (¾″) auger bit *or*
1	electric drill w/¾″ speed bit
1	steel tape
1	chalkline
2	claw hammers

Supplies

1 pc.	½″ x 48″ x 56″ sheathing material (precut). See Fig. 106-1.
⅛ lb.	6d box nails

Problem 2 (2 students)

Equipment

1	crosscut saw
1	claw hammer

Supplies

2 pcs.	½″ x 15″ x 48″ sheathing material (precut). See Fig. 106-1.
⅛ lb.	6d box nails

Overview (5)

1. From your reading, you have learned that three exterior elements of a structure are enclosed: the roof, walls, and floors.
2. I will show you the material you will be using for your wall sheathing and demonstrate to you how to prepare and install it on your structure.
3. In the laboratory activity you will measure, mark, cut, and nail the wall sheathing in place and cut out the window opening.

Demonstration (10)

Demonstration 1

This demonstration can be given by the instructor or by one group with the instructor's help.

1. Hold the large piece of sheathing against the front of the structure with the 56″ dimension vertical. Pull the bottom edge away from the frame so that the top edge slides down slightly; you can then see the tops of the studs.
2. On the top edge of the sheathing, mark the location of the stud centers.
3. Measure and mark the same stud centers on the bottom edge of the sheathing.
4. Snap chalklines through the marked points to show where the nails will be driven.
5. The sheathing is now ready for installation. It should be held up about ½″ off the floor for nailing.

Demonstration 2

After students have nailed sheathing to the front of the structure, a window opening is to be cut out. A short demonstration on boring the holes and sawing out the window should be given at that time.

Laboratory Activity (30)

Students will apply sheathing to the front and side of the structure.

1. Divide each group into two subgroups as follows:
   Three students will apply a ½″ x 48″ x 56″ piece of sheathing material to enclose the front of the structure (Problem 1).
   Two students will apply two pieces of sheathing to enclose the side of the structure (Problem 2).
2. Students are to follow the Laboratory Manual directions.
3. Give assistance as needed.
4. Allow time for clean up and return of equipment at the end of the period.

Safety Precaution

Avoid tipping the structure over. Work carefully.

Homework

Reading 57

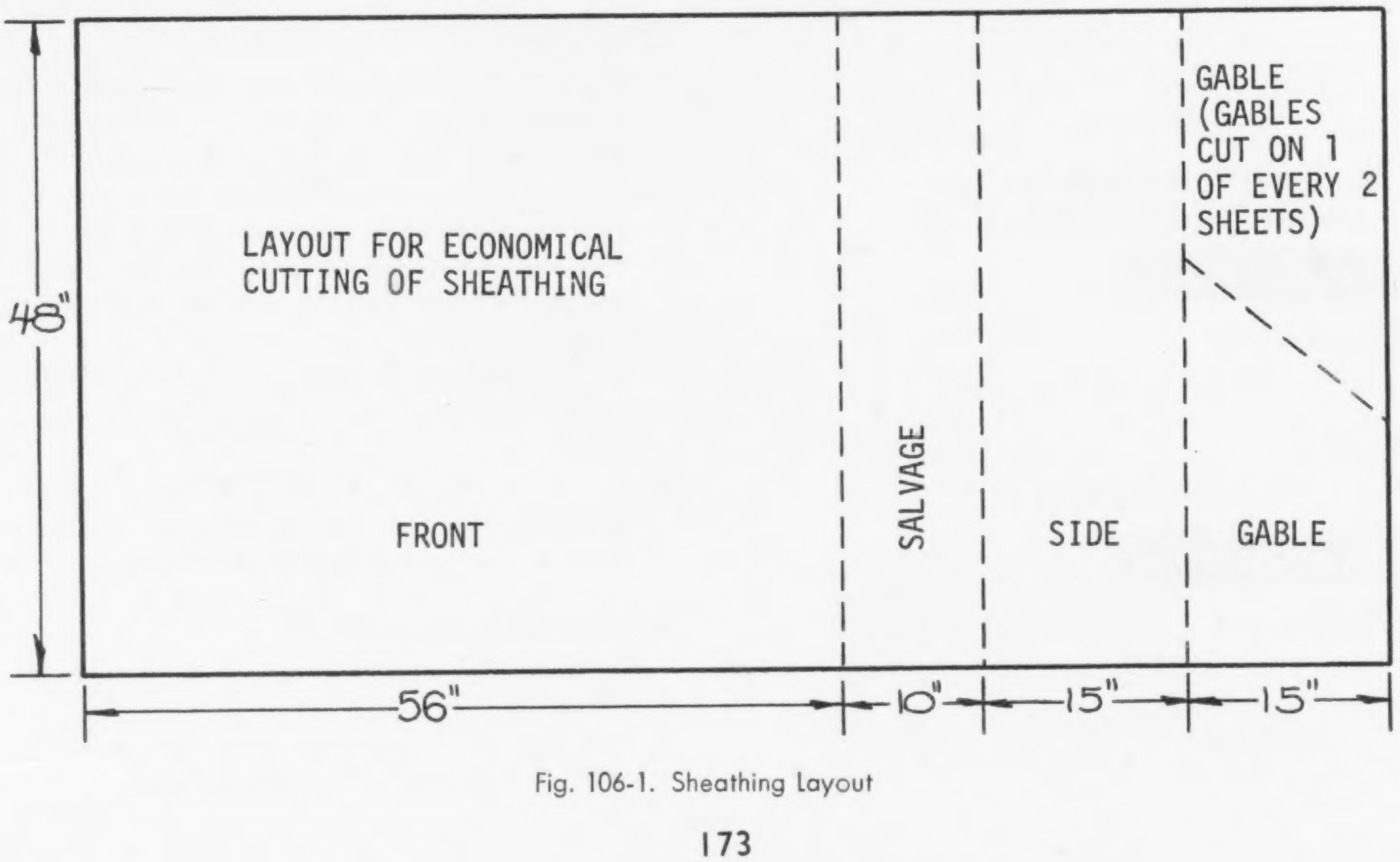

GABLE (GABLES CUT ON 1 OF EVERY 2 SHEETS)
LAYOUT FOR ECONOMICAL CUTTING OF SHEATHING
48"
FRONT
SALVAGE
SIDE
GABLE
56"
10"
15"
15"

Fig. 106-1. Sheathing Layout

ASSIGNMENT 107, UNIT 57A

Roofing

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to roofing:
   a. Give reasons why there are more flat or pitched roofs in your part of the United States.
   b. Give reasons why there is or is not evidence of a leaking roof on the ceiling in the room in which you are sitting.

Discussion

2. Given that there are two main types of roofs, name them.
3. Given that there are several steps in laying a built-up roof, name them.

Laboratory Activity

4. Given a structure, equipment, and supplies:
   a. Nail roof sheathing to the upper chords (rafters).
   b. Measure, cut, and apply building felt with a staple gun.

Time Schedule

5	Overview
10	Lecture-Discussion
15	Laboratory Activity
15	Demonstration

Equipment and Supplies for Lecture and Demonstration

Lecture

Equipment

1	overhead projector/screen

Supplies

1	Transparency 107

Demonstration

Equipment

1	utility knife
1	claw hammer
1	steel tape
1	chalkline

Supplies

½ lb.	½" galv. roofing nails
6	12" x 36" asphalt shingles
1 pc.	52¼" starter strip (cut from roll needed for Activity 57B)

Equipment and Supplies for Laboratory Activity

Problem 1

Equipment (Group of 5)

1	claw hammer
1	chalkline

Supplies (Group of 5)

1 pc.	½" x 24" x 48" sheathing grade (C-D) plywood, precut
1 pc.	½" x 2¾" x 24" sheathing grade (C-D) plywood, precut
⅛ lb.	6d box nails
1 pc.	50" galv. drip edge (optional)
1 pc.	24" galv. rake edge (optional)

Problem 2

Equipment (Group of 5)

1	utility knife
1	steel tape
1	staple gun w/9/16" staples

Supplies (Group of 5)

1 pc.	36" x 54", 15 lb. building felt
1 pc.	scrap wood, for cutting surface

Overview (5)

1. Your text reading explains that roofs are used to enclose the top of a structure and that a roof may be flat or pitched.
2. I will tell you about roofing and some of the techniques used to apply a roof.
3. You will be asked to name the two main types of roofs and to explain the steps in laying a built-up roof.
4. In the laboratory activity you will apply roof sheathing and building felt to your structure.
5. After your laboratory activity, I will demonstrate how to apply an asphalt shingle roof, using one of your structures.

Lecture-Discussion (10)

Combine the lecture with discussion, covering the points listed here.

1. The top of a structure may be enclosed with a *flat* roof or a *pitched* roof.

2. A flat roof is used most often for commercial or industrial construction. It is usually built up in several layers. A flat roof slopes *very slightly,* for drainage. (Show Transparency 107, Built-Up Roof.)
3. A pitched roof is used most often for house construction. However, pitched roofs are used sometimes on other structures to achieve a pleasing architectural effect. (For example: churches, auditoriums.)
4. *Flashings* are strips of material that seal the joints between the roofing and anything else that projects or rises above it. (For example: chimneys, vents, pipes, edges of a built-up roof.)
5. New liquid and one-layer roofing materials have been developed which show much promise in reducing labor costs and extending roof life.
6. Have students name the two main types of roofs. (Flat and pitched.)
7. Have students name the steps in laying a built-up roof. (Refer to Transparency 107 as an example.)

Laboratory Activity (15)

Students will have 15 minutes to complete the laboratory activity before the demonstration on shingling.

1. Have students follow the Laboratory Manual directions for applying roof sheathing (Problem 1) and then building felt (Problem 2).
2. The left edge of the large sheathing piece must be placed so that it lies along the center line of the first rafter. Check this installation on each structure.
3. Give help as needed.

Demonstration (15)

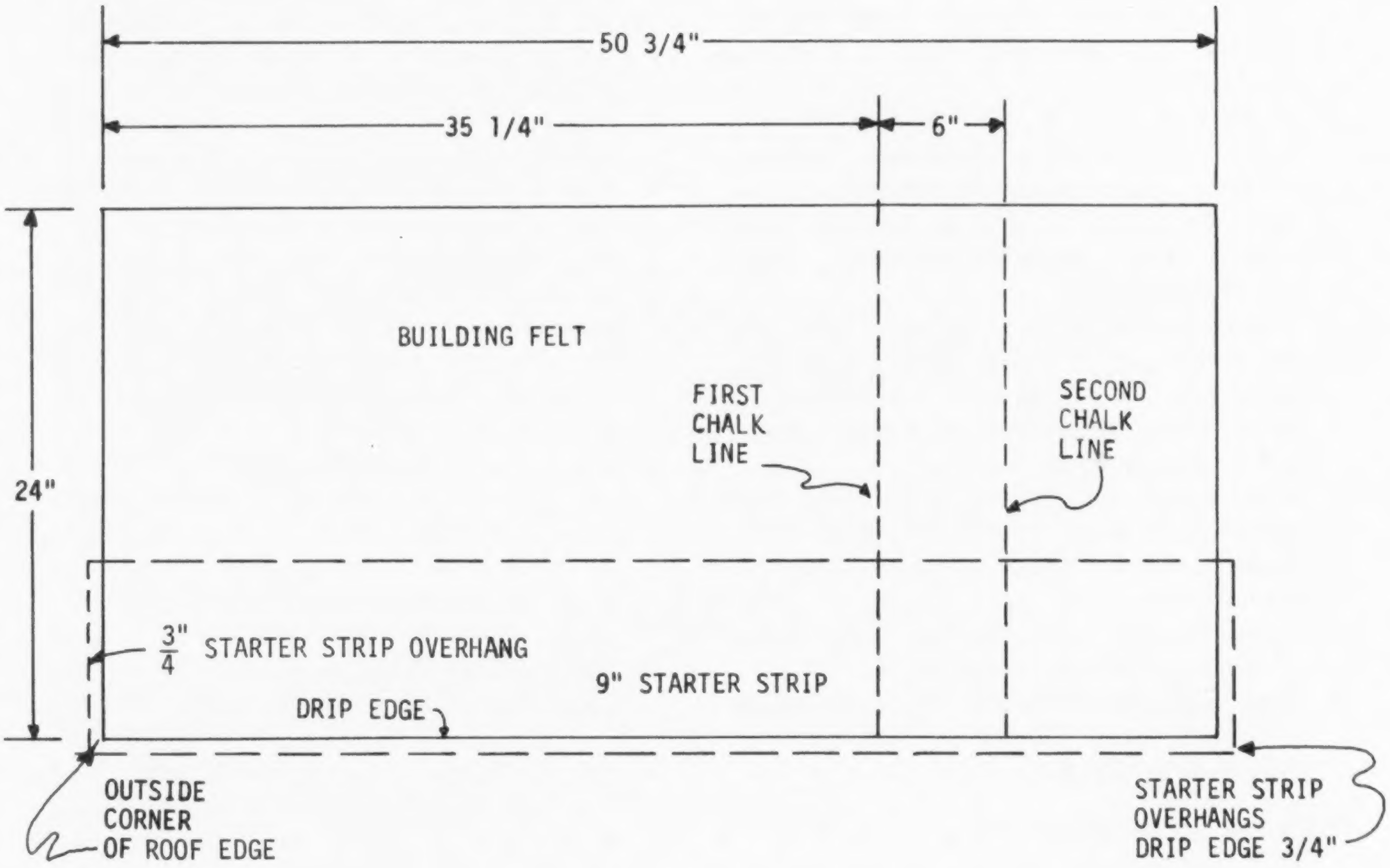
For this demonstration select a structure on which the roof sheathing, drip and rake edge, and building felt are completely installed.

1. Explain that you will now demonstrate the next day's activity, which will be to apply asphalt shingles to the roof.
2. Emphasize that before applying shingles, a roofer must lay out the area to be covered. Be sure that your students are grouped so that all of them can observe the procedure.
3. Measure and mark the top and bottom edge of the roof 35¼″ from the left (closed) end of the structure. See Fig. 107-1.
4. Measure 6″ to the right of your previous mark, at both the top and bottom of the roof, and mark these points. See Fig. 107-1.
5. Have a student help you snap a chalkline between each pair of marked points.
6. Nail a 9″ starter strip on the plywood so that it overhangs the roof by ¾″ on each end and along the drip edge (if used). Otherwise, nail with a ¾″ overhang over the fascia. Point this out to the students. (If a starter strip is not available, turn two shingles and nail them to the roof.)
7. Start your first course of shingles from the first chalkline (35¼″ mark). Lay one *full* shingle to the left. Use tin snips to cut a piece from another shingle to fit at the right. Cut it off so that it overhangs the roof ¾″.
8. Explain how shingles should be nailed: place the nails as shown in Fig. 107-2. Instruct students *not* to drive nails into the 2″ overhang along the left end.
9. *Instruct students not to drive the nails completely in.* This will simplify removal during salvaging.
10. The second course of shingles is started 6″ to the right of the first course; the second chalkline is the guide. Lay one full shingle to the left. Then cut pieces to fit at each end. *Cut both pieces from the remainder of the shingle cut for the first course.* See Fig. 107-2.
11. Point out to the students that the roofer measures up 5″ for each course so that 5″ of the preceding course will be exposed *to the weather.*
12. Explain that the third course will be laid just like the first course to obtain the alternating pattern.
13. Explain that for a regular, full-sized roof, the first chalkline would be located in the *middle* of the roof. This is done so that the end tabs in each course will be equal.
14. If there is any time left after the demonstration, use it for reviewing and discussing the demonstration.

   Note: Although the above technique may require a little more cutting than some alternate techniques, it is still minimal and three *full* shingles can be salvaged from each structure.

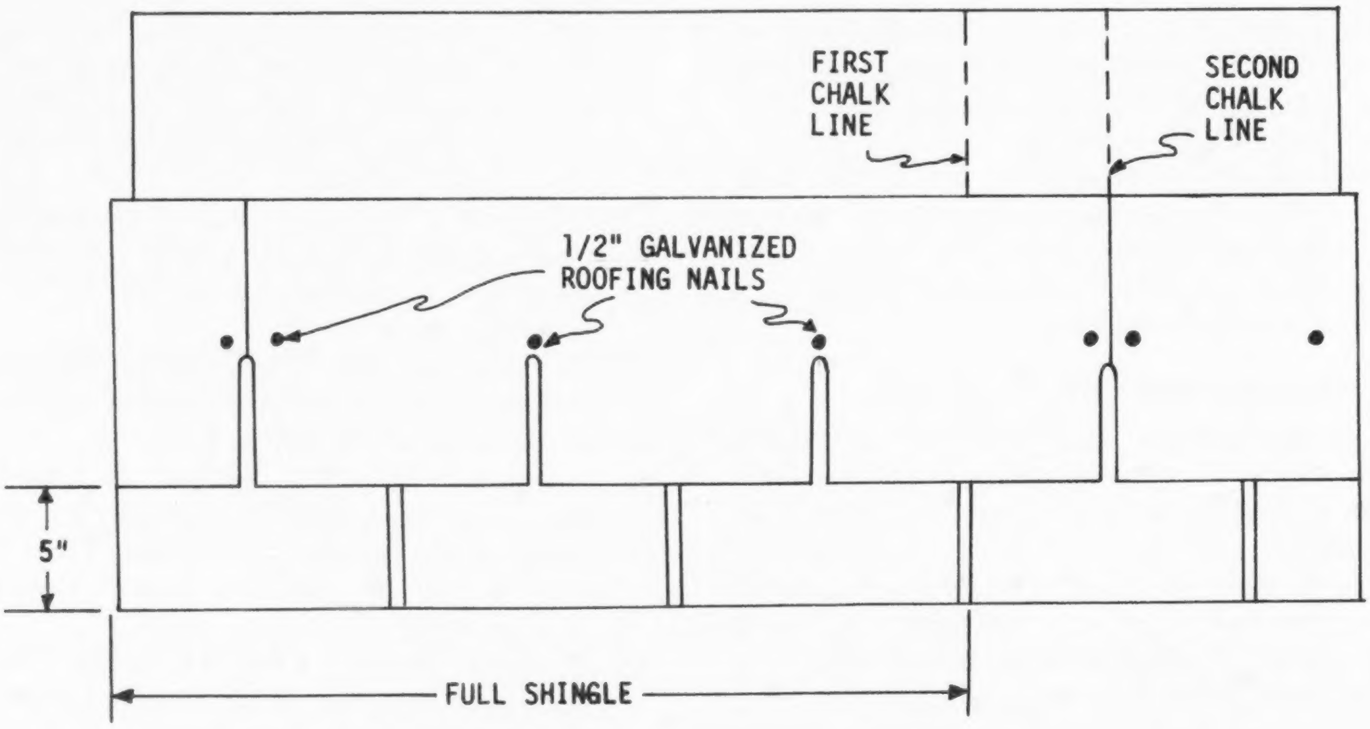
Homework

None



50 3/4"
35 1/4"
6"
24"
BUILDING FELT
FIRST CHALK LINE
SECOND CHALK LINE
$\frac{3}{4}$" STARTER STRIP OVERHANG
9" STARTER STRIP
DRIP EDGE
OUTSIDE CORNER OF ROOF EDGE
STARTER STRIP OVERHANGS DRIP EDGE 3/4"

Fig. 107-1. Roof Section Laid Out for Shingles



FIRST CHALK LINE
SECOND CHALK LINE
1/2" GALVANIZED ROOFING NAILS
5"
FULL SHINGLE

Fig. 107-2. First Two Courses of Shingles Laid 5″ to the Weather

ASSIGNMENT 108, UNIT 57B

Roofing

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a structure, equipment, and supplies:
   a. Apply three courses of an asphalt shingle roof.
   b. Assemble a window frame.

Time Schedule

5 Overview
40 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Problem 1 (3 students)

Equipment

1	utility knife
1	claw hammer
1	steel tape
1	chalkline

Supplies

½ lb.	½″ galv. roofing nails
6	12″ x 36″ asphalt shingles
1 pc.	9″ x 52¼″ starter strip, cut from roll

Problem 2 (2 students)

Equipment

1	claw hammer
1	nail set
1	2′ spirit level

Supplies

2 pcs.	¾″ x 4⅝″ x 16⅜″ wood, precut from 1″ x 6″ lumber (window frame sides)
1 pc.	¾″ x 4⅝″ x 11″ wood, precut from 1″ x 6″ lumber (window frame top)
1 pc.	¾″ x 6⅜″ x 14″ wood, precut from 1″ x 8″ lumber (sill)
2 pcs.	¾″ x 2¼″ x 16½″ wood, precut from 1″ x 4″ lumber (side trim)
1 pc.	¾″ x 2¼″ x 14″ wood, precut from 1″ x 4″ lumber (top trim)
1 pc.	¾″ x 2½″ x 14″ wood, precut from 1″ x 6″ lumber (interior sill)
½ lb.	8d finish nails
12	8d box nails

Overview (5)

1. Yesterday I demonstrated how to lay an asphalt shingle roof.
2. Today, some of you will lay an asphalt shingle roof on your structure.
3. The rest of you will assemble window frames which will be installed in a future activity.

Laboratory Activity (40)

1. Divide each group so that three students apply shingles (Problem 1) and two students build window frames (Problem 2). See Fig. 108-1.
2. Have students follow the directions in the Laboratory Manual.
3. Give assistance where needed.

Homework

Reading 58

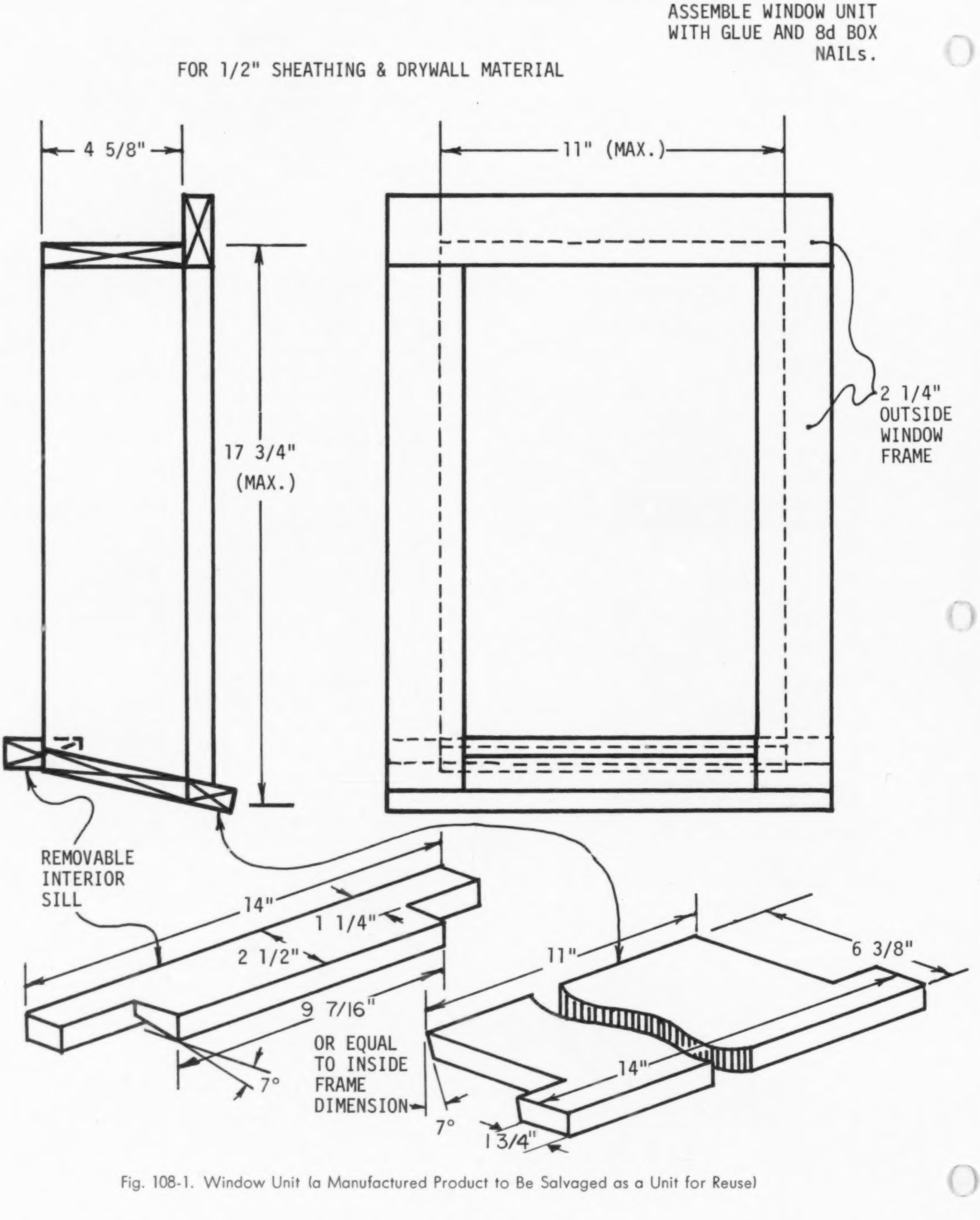

ASSEMBLE WINDOW UNIT WITH GLUE AND 8d BOX NAILs.
FOR 1/2" SHEATHING & DRYWALL MATERIAL
4 5/8"
11" (MAX.)
17 3/4" (MAX.)
2 1/4" OUTSIDE WINDOW FRAME
REMOVABLE INTERIOR SILL
14"
1 1/4"
2 1/2"
9 7/16"
7°
OR EQUAL TO INSIDE FRAME DIMENSION
11"
6 3/8"
14"
7°
1 3/4"

Fig. 108-1. Window Unit (a Manufactured Product to Be Salvaged as a Unit for Reuse)

ASSIGNMENT 109, UNIT 58A

Enclosing Exterior Walls

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to enclosing exterior walls:
   a. Explain why the exterior surface of a framed building is sometimes called the "skin" of the building.
   b. Name the most common type of "skin" or exterior surface on buildings in your neighborhood.

Laboratory Activity

2. Given the necessary tools and equipment:
   a. Apply building felt to the exterior walls of a structure.
   b. Locate and install a corner board on a structure.
   c. Lay out, cut, and install vertical siding on the gable end of a structure.

Time Schedule

5	Overview
15	Demonstration
25	Laboratory Activity

Equipment and Supplies for Demonstration

The instructor will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Problem 1 (Group of 5)

Equipment

1	staple gun/staples
1	steel tape
1	utility knife

Supplies

3 pcs. 15-lb building felt, as follows:
1 strip 36" x 72"
1 strip 18" x 72"
1 pc. to cover roof truss end (See Fig. 109-1.)

Problem 2 (Group of 5)

Equipment

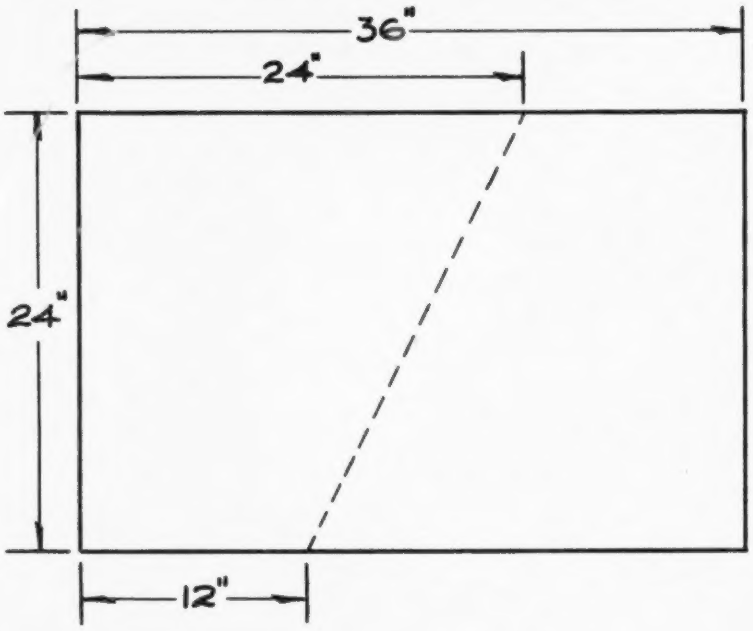
1	crosscut saw
2	claw hammers
1	framing square

Supplies

1 pc. 1" x 6" x 48" (minimum) V-joint (T&G) vertical siding
1 pc. 1" x 4" x 55¼" white pine or equiv.
1 pc. ¾" stock, for use in fitting corner board (scrap siding)
¼ lb. 8d box nails

Overview (5)

1. In your reading you learned that an architect chooses the material for covering the exterior of a structure. For masonry covering he may choose brick, concrete block, stone, etc. For other effects he may select wood siding, panels, or stucco.
2. Under the exterior finish materials, a moisture barrier of some sort usually is needed to keep dampness from penetrating into the wall cavity. I will show



Layout for cutting 36" building felt to cover roof truss at closed end. One 36" x 24" length can be cut to provide an end piece for two structures.

Fig. 109-1. Building Felt Layout

you how this is done, how to cut and install a corner board, and how to cut and install vertical siding on the gable end of your structure.

3. In your laboratory activity today, you will cover the walls of your structure with building felt which will serve as the moisture barrier. Next you will install the corner board. Then you will mark, cut, and install vertical siding.

Demonstration (15)

Three demonstrations probably will be necessary: (1) applying building felt, (2) installing a corner board, and (3) laying out, cutting, and installing vertical siding. It is recommended that each demonstration be given when the students are ready to perform that particular activity. You may follow the Laboratory Manual directions in detail or show only the critical steps. Additional suggestions are offered here.

1. **Building felt.** Explain that lapping the second course over the first helps direct any moisture to the outside of the structure.
2. **Corner board.** Explain that the ¼″ space at the top is provided for the soffit to fit into. Emphasize that this space and the ¾″ extension of the board edge beyond the wall edge are important. ¼″ plywood and ¾″ lumber may be used as guides or spacers.
3. **Vertical siding.** Demonstrate the use of the framing square in marking the angle cut. Emphasize that the grooved edge must *always* be the short one, and that the grooved edge of each piece should be the same length as the tongue of the preceding piece. Explain that face nailing is permissible because the nail heads will be covered by the return fascia and rake, still to be installed.
   Note: It has been recommended that the vertical siding be installed on only a portion of the short wall, for two reasons: (1) the students gain the benefit of using this material at a minimum cost and (2) in actual practice various types of masonry surfaces could be applied to cover the remainder of the wall.

Laboratory Activity (25)

1. Move from group to group giving assisttance as needed.
2. At appropriate times, give Demonstrations 2 and 3.

Safety Precautions

1. Never point a staple gun at any portion of anyone's body.
2. Take care when using a utility knife.

Homework

None

ASSIGNMENT 110, UNIT 58B

Enclosing Exterior Walls

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a wood frame structure and necessary equipment and supplies:
   a. Install soffit.
   b. Measure, cut, and install return fascia and rake.

Time Schedule

5 Overview
10 Demonstration
30 Laboratory Activity

Equipment and Supplies for Demonstration

The teacher will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Problem 1 (2 students)

Equipment

1	claw hammer
1	nail set

Supplies

1 pc. 1/4" x 5 1/2" x 48" plywood
1/4 lb. 4d finish nails

Problem 2 (3 students)

Equipment

1	steel tape
2	claw hammers
1	nail set
1	crosscut saw
1	T-bevel
1	block plane

Supplies

1/4 lb. 8d finish nails
1 pc. 1" x 6" x 24" lumber (No. 2 WP or equiv.)
1 pc. 1" x 2" x 30" lumber (No. 2 WP or equiv.)

Overview (5)

1. Yesterday you applied building felt and installed the corner board and vertical siding on your structure.
2. Today I will show you how to install the soffit and how to measure, cut, and install a part of the fascia and the rake.
3. In your laboratory activity, you will complete any of yesterday's work not already done. Then you will install the soffit, fascia, and rake.

Demonstration (10)

1. Demonstrate the correct procedures for installing soffit: placing the soffit, overhead nailing, and use of a nail set. See Laboratory Manual, Activity 58B.
2. Demonstrate fitting and nailing the butt joint used in joining the fascia at the corner.
3. Demonstrate using the sliding T-bevel to find the rake angle, laying out the rake, checking its fit, and installing it.

Laboratory Activity (30)

It is suggested that you divide the work activities as follows:

1. Assign two students in each group to install the soffit (Problem 1).
2. Assign three students in each group to complete the vertical siding installation, and then install the return fascia and rake (Problem 2).
3. Give individual help as needed.

Homework

Reading 59

ASSIGNMENT 111, UNIT 59

Striking

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to striking:
   a. If there has been a strike in the construction industry in your locality within the past few months, tell what brought it about.
   b. Identify who loses and why, when a strike occurs.

Discussion

2. Given questions:
   a. State four conditions under which the government may intervene in settling a strike.
   b. State three ways the government can aid in settling strikes.

Laboratory Activity

3. Given a wood frame structure, a window frame, and the necessary equipment and supplies:
   a. Install the window frame unit in the structure.
   b. Bend flashing and install it over the window.
4. Given a hypothetical labor-management dispute and resulting strike, participate as a negotiator, an observer, or a member of a picket line.

Time Schedule

5	Overview
10	Lecture-Discussion
30	Laboratory Activity

Equipment and Supplies for Lecture-Discussion

Equipment

1	overhead projector/screen
1	grease pencil or felt pen

Supplies

1 set	Transparencies 111-1, 111-2, 111-3

Equipment and Supplies for Laboratory Activity

Problem 1 (Group of 5)

Equipment

1	claw hammer
1 pr.	aviation snips
1	level
1	rule
1	nail set
1	scribe
1	bar fold (optional)
or	
2	C-clamps
and	
1	wooden mallet

Supplies

1	window frame unit (from Activity 57B)
1 pc.	6″ x 16″, 20 gauge sheet metal (galvanized or aluminum), for flashing
4	8d finish nails
2	½″ No. 18 galvanized or aluminum roofing nails

Problem 2 (Group of 5)

Equipment

1	crayon, pen, or grease pencil

Supplies

5 pcs.	paper, for sketching poster designs
1 pc.	approx. 18″ x 25″ poster board, for sign. (Cut according to sizes available in your area.)
1 pc.	approx. 1″ x 1″ x 24″ lumber (or substitute) for picket signs

Overview (5)

1. Your text reading explained strikes and the effects they have on the construction industry.
2. I will tell you more about the general effects of a strike and how the government can help settle a strike.
3. You will be asked questions about *when* the government can help settle a strike and *what* the government can do.
4. In the laboratory activity, you will first install the window frame unit and flashing in your wood frame structure.
5. After the construction work is completed, you will try to solve a dispute regarding the structures.

Lecture-Discussion (10)

Today we will consider why strikes occur, their bad effects, and the federal government's role in a strike.

(**Note**: Part of today's lecture material is presented on three transparencies. They are reproduced here, along with suggestions for their use. You may want to cover each transparency with a sheet of paper, and then uncover the items one by one as you discuss them. Do not spend a great deal of time going into detail.)

1. Most strikes occur after many other means of settling a labor-management dispute have been tried. They are called because labor and management can no longer communicate (talk in a helpful way) about the issues.
2. Strikes hurt the employer, the workers, and the community. Time and money are lost. Angry feelings may develop and persist for a long time afterward.
3. a. Show Transparency 111-1, Effects of a Strike.
    1) The Contractor:
        a. He receives no money for the project.
        b. Overhead costs continue (office, etc.)
        c. Payments on new and leased equipment continue.
    2) The Workers:
        a. They are not being paid. (If paid by union, payments are small.)
        b. Bills continue for food, rent, etc.
        c. Bad feelings between labor and management may go on, even after the strike is settled.
    3) The Community:
        a. Much needed projects are delayed (roads, schools, housing, etc).
        b. Fewer goods and services are bought, which hurts stores, repair shops, etc.

    b. Discuss each item briefly.
4. a. Show Transparency 111-2, Conditions Under Which the Federal Government Will Act to Stop a Strike.
    1) When the strike causes great inconvenience to the public.
    2) When the strike is harmful to the local or national economy.
    3) When the strike is a threat to public health or safety.
    4) When the strike is harmful to the defense program.
    5) When the strike has a harmful effect on countries outside the United States, or when it affects the opinion foreign countries have of America.

    b. Ask students to suggest examples under each of the five headings. Write their answers on the transparency with a grease pencil or water color pen.
5. a. Show Transparency 111-3, Major Ways in Which the Federal Government Will Intervene in a Strike.
    1) Appointing a fact-finding board to study the case.
    2) Forcing the parties to try mediation.
    3) Compelling the parties to accept arbitration.
    4) Issuing an injunction (court order) that requires the strikers to go back to work.

    b. Explain that issuing an injunction (Item 4) is seldom necessary, but it is lawful under the "emergency dispute provision" of the Taft-Hartley Act.
6. Review the main points of the lecture by asking questions as time permits.

Laboratory Activity (30)

You will be directing two separate laboratory activities today. Allow 10 minutes for the first and 20 for the second.

1. Instruct the class to follow the directions in the Laboratory Manual for installing the window flashing. Inform them that they have 10 minutes to complete their work and to clean up.
2. In the second activity students will be trying to settle a dispute. It is fictional but represents a real situation.
3. Read the Strike Situation (Problem 2 in the Laboratory Manual) to the students.
4. Allow 5-10 minutes for setting up the activity, Items 5-9.
5. Assign all class foremen as representatives of management and assign the other students to represent labor. Have each group study their positions and list suggestions for solving the dispute.
6. Assign some workers to make picket

signs and to arrange the classroom for the labor dispute. See Fig. 111-1.

7. Have students quickly sketch ideas for a poster sign that could be used in a picket line. Emphasize that signs should be as brief and creative as possible so that people will see and read them.
8. Select five ideas, or let each student group select one. Have some students make the signs and staple them to 1" x 1" x 24" sticks, or fasten each to a piece of string (to hang around the neck).

   Area A—Picket Line. Try to place this area near the students' structures. Explain that a picket line would be located *outside,* at the construction site.
   Area B—Negotiation Meeting. Use a table or bench. Explain that this meeting would be held at the contractor's office or union headquarters.
   Area C—Construction Site.
9. Arrange the representatives at the table or bench. Select five (or more) students to walk the picket line with the signs.
10. For the remainder of the period, *representatives from management and labor are to discuss the dispute and try to find a way to stop the strike.* The picket line members must keep moving as they listen. (You may want to switch student roles occasionally to allow fuller participation.)

Homework

None

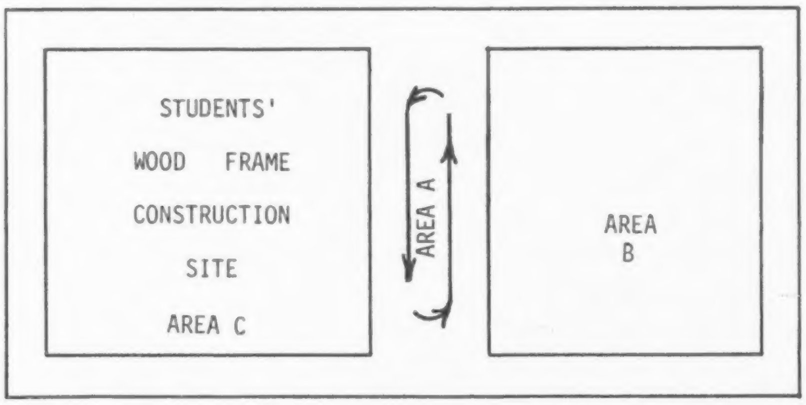


Fig. 111-1. Suggested Arrangement of Classroom for Labor Dispute

ASSIGNMENT 112, UNIT 58C

Enclosing Exterior Walls

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the necessary equipment and supplies, prepare and install lap siding.

Time Schedule

5	Overview
10	Demonstration
30	Laboratory Activity

Equipment and Supplies for Demonstration

The teacher will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	try square
1	framing square
2	claw hammers
1	brace w/No. 8 (½") auger bit
1	crosscut saw
1	compass saw *or* saber saw

Supplies (Group of 5)

6 pcs.	¼" x 12" x 48" hardboard siding* *or* ¾" x 12" x 48" lumber
1 pc.	¼" x 2" x 48" starter strip *or* ¾" x 12" x 48" lumber (cut in advance)
¼ lb.	6d galv. box nails

*These can be cut in advance from a 4' x 8' sheet.

Overview (5)

In yesterday's activity, you saw how a labor dispute can interrupt a construction job. Some disputes can be settled quickly to the satisfaction of all parties. Some disputes continue for long periods of time, and all parties suffer in the long run.

1. Today I will demonstrate how the siding

you will use on your structure is prepared and applied.

2. Now that you are back on the job, you will apply the siding to the outside of your structures.

Demonstration (10)

1. Explain the purpose of the starter strip. (To give the same slant to the first piece of siding that the others will have.)
2. Demonstrate the fitting and nailing of the siding.
    a. Emphasize holding the bottom edge of the first piece at least ½″ above the surface of the floor.
    b. Emphasize nailing each board *only near* the bottom edge—1″ up from the bottom—through each stud.
3. When one group is ready to prepare the third course, demonstrate marking and cutting to fit around the bottom of the window frame. Use the technique of drilling holes and cutting an opening with a compass saw, then finishing with a crosscut saw.

Laboratory Activity (30)

1. Direct the activities of the groups by moving among them, giving advice and assistance where needed.
2. If any previous activities are still incomplete, some students may use this time to finish them.
3. On the succeeding day (Assignment 113, Glazing Techniques), additional time is allotted for completing the siding task.

Homework

None

ASSIGNMENT 113, UNIT 58D

Enclosing Exterior Walls

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given a demonstration on installing glass, state two techniques for glazing glass and the conditions for using each technique.

Laboratory Activity

2. Given the necessary equipment and supplies, complete the enclosure of the exterior walls.

Time Schedule

5	Overview
15	Demonstration
5	Discussion
20	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	steel tape
1	claw hammer
1	putty knife
1	miter box
1	overhead projector/screen

Supplies

1 sht.	10″ x 16½″ single-strength glass
12	glazier's points
½ lb.	glazing compound *or* ¾″ x ¾″ x 36″ quarter-round molding

Transparencies 113-1, 113-2

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	try square
1	framing square
2	claw hammers
1	brace w/No. 8 (½″) auger bit
1	crosscut saw
1	compass saw *or* saber saw

Supplies (Group of 5)

Same as 58C (No new supplies)

Overview (5)

1. Today I will demonstrate how to install a pane of glass in your structure. This practice is called *glazing.*
2. You will be asked to identify two techniques for glazing glass and the conditions for using each technique.
3. In the laboratory activity you will continue enclosing the exterior of your structure.

Demonstration (15)

(**Note:** Two alternate techniques are suggested for glazing. Transparency 113-1, Glazing with Molding, shows the use of molding or rabbeting inside the glass with glazing compound outside. Transparency 113-2, Glazing with Compound, shows glass held in place with molding strips inside and outside. Select in advance the technique you prefer to demonstrate, and secure the demonstration materials for that technique.)

1. Show both transparencies. Point out that one technique is suitable only for fixed windows (those that will not be opened).
2. Explain that since window frames and sash normally are manufactured products, glazing a sash by hand is most frequently a maintenance procedure.
3. Apply small beads of glazier's compound to the rabbet or molding as a pad for the glass to go against.
4. Press the pane of glass into position and apply glazier's points. Explain that the purpose of the glazier's points is to hold the glass tight against the molding.
5. Finish glazing the sash according to the technique you have chosen.

Discussion (5)

1. What are two common techniques of glazing? (Glazing with glazing compound and glazing with molding.)
2. When should each technique be used? (Molding is preferred for fixed glass, and glazing compound is preferred for movable window and door units.)

Laboratory Activity (20)

1. Students are to continue the siding task. They should complete this and all other work up to this point, if possible.
2. Give individual help as needed. In particular, help any group that needs to catch up.

Homework

Activity 58E is optional. If it is used, there is no homework. If Activity 58E is omitted, assign Reading 60. **Note:** If Optional Activity 61D is used, you will need to have built in advance several simple frames simulating unfinished walls. See Assignment 119.

ASSIGNMENT 114, UNIT 58E (OPTIONAL)

Enclosing Exterior Walls

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the necessary equipment and supplies:
   a. Mix mortar for laying bricks.
   b. Lay three courses of bricks correctly.

Time Schedule

5	Overview
10	Lecture-Demonstration
30	Laboratory Activity

Equipment and Supplies for Lecture-Demonstration

The instructor will use the equipment and supplies needed for one group of students, to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	brick trowels
1	brick chisel *or* brick hammer
1	3/8″ jointing tool
1	24″ level
1	mortar board
1	mason's line

Supplies (Group of 5)

25	common face bricks
1 pc.	36″ x 72″, No. 5 building felt *or* plastic sheeting

Equipment (Per class)

1	mortar box *or* wheelbarrow
1	mixing hoe
1	shovel
1	bucket of water

Supplies (Per class)

1	80 lb. bag mortar mix ~~or ready-~~mix mortar

Overview (5)

1. Your text described several masonry materials used to enclose exterior walls, how they are applied, and who does the work.
2. I will demonstrate some bricklaying techniques and point out to you the tools used in the bricklaying trade.
3. In your laboratory activity, you will mix mortar and lay three courses of brick. You will then clean the bricks you used so they can be reused by the next class.

Demonstration (10)

1. Review and demonstrate laying a mortar bed (Fig. 114-1), "buttering" the end of a brick, leveling, and aligning. (See Laboratory Manual.)
2. Show wall ties or any other bricklaying supplies available to you.

Laboratory Activity (30)

1. A dummy course of bricks (or a length of 2″ x 6″ or previously made footings) will be used to simulate a foundation.
2. Move among the groups, giving necessary advice or assistance with mixing mortar, laying a mortar bed, buttering, leveling, aligning, and cutting bricks.
3. Allow enough time for students to clean the bricks and equipment so they will be ready for the next class.
4. If you water down the mortar, it may be suitable for reuse by the next class.

Homework

Reading 60

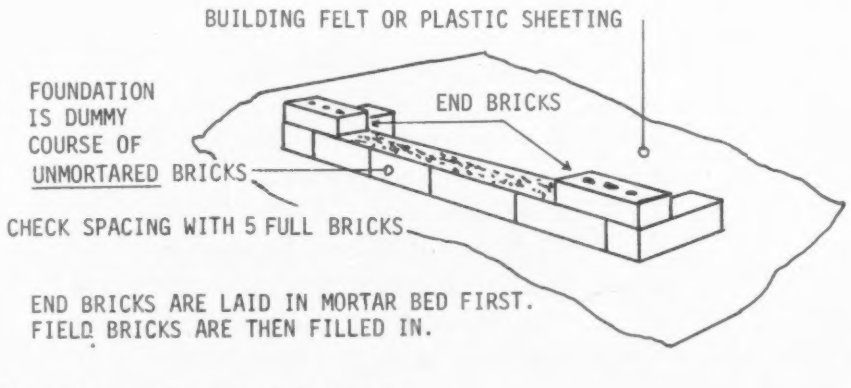

BUILDING FELT OR PLASTIC SHEETING
FOUNDATION IS DUMMY COURSE OF UNMORTARED BRICKS
END BRICKS
CHECK SPACING WITH 5 FULL BRICKS
END BRICKS ARE LAID IN MORTAR BED FIRST. FIELD BRICKS ARE THEN FILLED IN.

Fig. 114-1. Layout for Bricklaying

ASSIGNMENT 115, UNIT 60

Insulating

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to insulating:
   a. Give reasons why it would be better to have or not to have insulation in the walls and ceilings if your home caught on fire.
   b. Tell how you could find out if there is any insulating material in the outside walls and the ceilings in your home.

Discussion

2. Given questions:
   a. State three uses for insulation.
   b. Identify four common forms of insulation.

Laboratory Activity (Optional)

3. Given the necessary equipment and supplies, measure, cut, and install blanket insulation.

Time Schedule

5	Overview
15	Demonstration-Discussion
25	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	heat lamp
1	electric drill
1	extension cord (if needed)

Supplies

2	8″ x 16″ concrete blocks
2 pcs.	4″ x 10″ sheet metal
1 pc.	4″ x 10″ insulation (for one plate)
2 pcs.	candle wax *or* paraffin
2	cardboard boxes. (Wastebaskets or buckets also may be used.)
1 pc.	blanket insulation, to line the entire inside of one cardboard box
1 roll	masking tape, for installing concealed insulation in one box

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)*

1	staple gun/staples
1	steel tape
1	straightedge (straight board)
1	utility knife
1	screwdriver

Supplies (Group of 5)*

1 pc.	43″ length of blanket insulation, to be cut from 2″ x 14½″ roll
1 pc.	scrapwood, for use as cutting board

* Decide in advance whether you will have students perform this activity or will demonstrate the procedures to them. See note under "Laboratory Activity."

Overview (5)

1. Your text reading explained why insulation is used, gave examples of materials commonly used, and described the basic forms in which insulation is available.
2. Today I will demonstrate the effect that insulation has on heat and sound.
3. You will be asked questions about the uses of insulation and will be asked to name several forms commonly used.
4. (Optional) In the laboratory activity, you will install insulation in your structure.
   OR
   (Otherwise) I will demonstrate how blanket insulation is installed.

Demonstration-Discussion (15)

1. Prepare the materials before class as shown in Fig. 115-1 and Fig. 115-2, and arrange them on a bench.
2. Review the main uses of insulation. (To prevent or decrease the passage of sound, heat, moisture, and/or fire.)
3. Review the main forms in which insulating material comes. (Loose fill, flexible batts, and rigid panels.)
4. Tell the class that you will now demonstrate two effects of insulation.
5. Plug in the lamp. Explain that you have placed insulation between the heat source and *one* of the pieces of wax. Ask your students what effect they expect this will have when the lamp is on. (Insulation slows down heat transfer through metal, so the wax on the insulated metal

will not melt as quickly as the wax on the unprotected metal.)

6. Turn on the lamp. Let the class observe the effect and discuss it.
7. Tell the class that they must now decide without looking, which of two boxes is insulated. Place one of the boxes over a *running* portable electric drill. Have students listen to the sound that comes through the box walls.
8. Remove this box and cover the drill with the other box. Have students listen again, and decide which box allowed more sound to pass through. Let the class examine the boxes and discuss the difference in the levels of sound they transmit.
9. During or after the demonstration, ask the following questions:
   a. Why is insulation built into structural parts of houses? (To prevent the escape of heat from the rooms during the winter, and to keep the rooms cooler in the summer. To prevent or decrease the passage of sound. To shut out dampness. To prevent fire or keep it from spreading.)
   b. Name some common forms of insulation. (Loose fill, blankets or batts, rigid panels or boards, metallic sheets.)
   c. What determines the kind of insulation needed in a structure? (Climate, noise level within the structure, temperature needs of occupants, etc.)

Laboratory Activity (25)

Note: Problem 1 (installing insulation) is an optional activity. If, because of safety factors or health regulations, you prefer not to have students handle insulating material, you should demonstrate the procedures using one of the structures.

1. Caution students to handle the insulating material *only* when necessary.
2. Choose one student from each group to lay out and cut insulation.
3. Supervise the activity carefully.
4. See that all students wash with soap and warm water after handling the insulation.

Safety Precautions

1. Avoid unnecessary handling of insulating material. It is difficult to remove from clothes, and it sometimes irritates the skin.
2. Check the type of insulation you receive. Some kinds irritate the skin more than others.

Homework

Reading 61

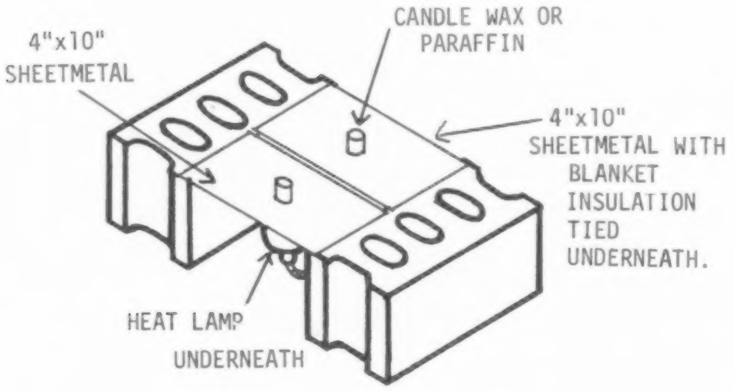


Fig. 115-1. Transfer of Heat from Radiant Source, with and without Insulation

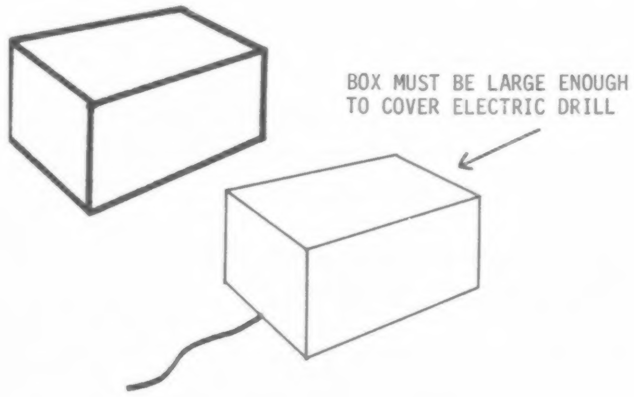


Fig. 115-2. Transfer of Sound Through Insulated and Uninsulated Box Walls

ASSIGNMENT 116, UNIT 61A

Applying Wall Materials

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to applying wall materials:
   a. Identify the kinds of wall materials used to cover the interior walls in your bedroom, living room, and bathroom, and give reasons why the materials are the same or different.
   b. Describe the major difference between the interior walls of your school classrooms and those in your home.

Laboratory Activity

2. Given the necessary equipment and supplies, measure, cut, and install gypsum board (drywall) to cover the inside of the long wall of the structure.

Time Schedule

5 Overview
15 Demonstration
25 Laboratory Activity

Equipment and Supplies for Demonstration

The teacher will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	claw hammer
1	4′ straightedge (straight piece of board)
1	utility knife
1	framing square
1	compass saw
1	screwdriver
1	steel tape

Supplies (Group of 5)

1 pc.* $3/8''$ x 45″ x 48″ gypsum board, to be cut by students from larger piece
1 box rock-lath nails

* If the short wall also is to be covered with gypsum board, each group will need another piece about 12″ x 48″. *With this alternative, you will omit the paneling in Activity 61C, Problem 2.*

Overview (5)

1. The text has explained that interior wall materials may be applied to the inside of exterior walls and to both sides of all partitions or room dividers. Some of the materials suitable for this purpose are wood and wood products, plaster and lath, masonry, fabrics, metal, glass, plastic, ceramic tile, and gypsum board (sometimes called *drywall*).
2. I will demonstrate some of the techniques used in preparing and installing a sheet of gypsum board (drywall). Watch especially as I show you how to locate and cut out holes so the gypsum board will fit around plumbing lines, electrical outlet boxes, and window opening.
3. In the laboratory activity, you will install gypsum board on an inside wall of your structure.

   Note: The names for widely used wall materials are not always applied uniformly. The following usage is suggested. The terms *gypsum board* and *plasterboard* may be used interchangeably. The material comes in large sheets (4′ x 8′ and larger). The surface is relatively nonabsorbent so that plaster will not bond to it. It is usually finished by painting.

   The terms *rock lath* and *gypsum lath* may be used interchangeably. The material comes in smaller sheets. The surface is relatively absorbent so that plaster will bond to it. The material is intended as a base for plaster.

   So-called drywall material may be either common plasterboard or prefinished plasterboard.

Demonstration (15)

1. Demonstrate how to lay out and cut a large sheet. Emphasize these points:
   a. Measure from a factory-cut end whenever possible.
   b. Cut *through* the outside covering of the gypsum board with the utility knife.
   c. Break *away* from the first scored mark.
2. Explain to the students that each 45″ x

48″ piece will be divided into two pieces so they will have an opportunity later to tape a joint.

3. Emphasize the importance of having the beveled edges meet to form a joint which can be taped.
4. Demonstrate how to mark for cutouts with pieces held or tacked in position.
5. When marking for cutouts by transferring measurements, the workman marks on the *face* side of the drywall.
6. An alternate technique of marking for electrical box cutouts may be used: Rub chalk on the outlet box where it will contact the back surface of the drywall sheet as it is held in place. Tap the sheet firmly with the heel of the hand. Remove the sheet; the chalk will have transferred onto the back surface. Proceed to cut out the opening as marked on the back surface.
7. Demonstrate techniques of making cutouts:
   a. Pierce with a screwdriver.
   b. Score and break with a utility knife.
   c. Cut with a compass saw.
8. Demonstrate driving nails slightly below the surface with a hammer. "Dimple" the nail heads. Explain that this leaves a depression or dent into which joint cement can be applied to cover the nail heads.

Laboratory Activity (25)

1. If you have elected to use gypsum board also on the inside of the short wall of the structure, it is recommended that each group be subdivided today, so that three students apply the material to the longer wall while two others apply it to the short wall. You will then omit the paneling activity (Problem 2 of Activity 61C).
2. Supervise the activity and assist the students as needed.

Safety Precautions

1. Keep fingers away from the cutting edge of the utility knife.
2. To protect yourself and others from being cut, carry all sharp instruments carefully.

Homework

None

ASSIGNMENT 117, UNIT 61B

Applying Wall Materials

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the necessary equipment and supplies, apply joint cement and joint tape to an interior wall surface.

Time Schedule

5 Overview
10 Demonstration
30 Laboratory Activity

Equipment and Supplies for Demonstration

The teacher will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	tape knife
1	finishing trowel
1	claw hammer
1	mortar board for joint cement

Equipment (Per class)

1	bucket
1	measuring cup

Supplies (Per class)

1 pkg.	joint-treatment cement
1 roll	joint tape
	water
	rags

Overview (5)

1. You have read that it is necessary to tape and cement over gypsum board joints and nail heads. You can now see why this is an important part of the total job.
2. Today I will demonstrate how joint cement is mixed and how it is applied with joint tape.
3. You will then mix and apply the first coat of joint cement and tape.

Demonstration (10)

1. Mix joint cement by adding *dry ingredients to the water,* mixing constantly to keep the cement smooth and even-textured.
2. Drive in any nail heads along the joint so that a dimple is made by the hammerhead.
3. Apply joint cement to the joint with a tape knife or steel float.
4. Imbed dampened tape in the fresh cement, using the tape knife or steel float.
5. Apply joint cement to fill hammer marks and cover nail heads.

Laboratory Activity (30)

1. Assist any groups that have not yet finished applying gypsum board.
2. Advise and assist students in today's laboratory activity as needed.
3. Supervise the clean-up task to see that equipment is properly cleaned and left-over cement is deposited in a waste container.

Precaution

Cement must not be dumped into plumbing drains.

Homework

None

ASSIGNMENT 118, UNIT 61C

Applying Wall Materials

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the necessary equipment and supplies:
   a. Sand over a first coat of joint cement and apply a second coat.
   b. Scribe, cut, fit, and install paneling.

Time Schedule

5 Overview
10 Demonstration
30 Laboratory Activity

Equipment and Supplies for Demonstration

The teacher will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Problem 1

Equipment (3 students)

1	tape knife
1	finishing trowel
1	mortar board for joint cement

Supplies (3 students)

¼ sht. 1/0 abrasive paper

Equipment (Per class)

1	bucket
1	measuring cup

Supplies (Per class)

1 pkg. joint treatment cement

Problem 2

Equipment (2 students)

1	compass w/pencil
1	claw hammer
1	try square
1	block plane

1	ratchet brace with No. 8 (½″) auger bit *or*
1	electric drill with ½″ speed bit
1	nail set
1	compass saw *or* sabre saw

Supplies (2 students)

1 pc.*	¼″ x 11″ x 48″ paneling (precut)
10	4d finish nails
1 pc.	chalk

* The thickness or type of paneling is relatively unimportant to the concepts involved. Use whatever is available at reasonable cost. However, the outlet box installation must be based upon the material actually used.

Overview (5)

1. You have already learned that there are many ways of enclosing interior walls other than gypsum board.
2. I will show you how to prepare a wall for a second coat of joint cement and the procedures to follow in preparing and installing paneling.
3. In your laboratory activity some of you will sand the first coat of joint cement and apply another coat. Some of you will scribe, cut, fit, and install paneling.

Demonstration (10)

1. Demonstrate sanding the first coat of joint cement to prepare the wall surface for another coat.
2. Demonstrate scribing and fitting paneling.
   a. Point out that locating the switch box cutout on the paneling is somewhat like locating the duplex outlet box cutout on the gypsum board (Activity 61A).
   b. When you demonstrate the scribing technique, explain that some structures, especially older ones, have very irregular wall edges which make this fitting technique important.
   c. Caution students to use great caution in drilling and sawing the cutout to avoid splitting the finish side of the paneling.

Laboratory Activity (30)

1. It is suggested that each group be subdivided for this activity, with three students assigned to Problem 1 (sanding and filling) and two students assigned to Problem 2 (installing paneling).
2. Give advice and assistance as needed.

Homework

If Optional Assignment 119 is used, there is no homework. If Assignment 119 is omitted, assign Reading 62.

ASSIGNMENT 119, UNIT 61D (OPTIONAL)

Applying Wall Materials

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the necessary equipment and supplies, mix and apply a brown coat of plaster to a simulated wall section.

Time Schedule

5	Overview
15	Demonstration
25	Laboratory Activity

Equipment and Supplies for Demonstration

The instructor will use the equipment and supplies needed for one group of students, to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	finishing trowels
1	hawk, for plaster
1	simulated wall frame w/rock lath applied

Supplies (Group of 5)

1	24″ straightedge (scrap wood)

Equipment (Per class)

1	broom
1	wheelbarrow
1	mixing hoe
1	bucket, for water to mix with plaster
1	barrel, for water to clean tools

Supplies (Per class)

2½ gal.	water, for mixing
40 lb.	mill-mixed gypsum plaster
	quantity of sand (as recommended on gypsum plaster bag)
	water, for cleaning
2 shts.	3/8″ x 16″ x 48″ rock lath

Overview (5)

1. You have been working with rigid wall materials. Plaster is applied as a semisolid. It hardens to form a high-quality interior wall surface.
2. I will demonstrate how plaster is mixed and applied to form a wall surface.
3. You will then be given an opportunity to follow instructions and try your hand at plastering a surface.

Demonstration (15)

1. Have prepared in advance several simulated wall frames, with rock lath and plaster ground applied, ready for plastering. See Fig. 119-1. Use one of these for the demonstration.
2. Mix gypsum plaster, sand, and water. Emphasize the importance of pulling dry mixture into the water with the hoe.
3. Place plaster on a hawk. Show how to cut it off and load the trowel.
4. Start applying plaster at the bottom of the frame.
5. After sufficient plaster has been applied, strike off the excess with a straightedge. This should leave the surface even with the plaster ground.
6. Brush the surface with the broom, leaving a textured finish to prepare it for holding a finish coat.

Laboratory Activity (25)

1. Have frames set up in an area in which the floor has been covered with building felt or plastic.
2. Have one person from each group get the plaster on the hawk and carry it to the assigned work area.
3. Instruct group foreman to see that each person has a chance to try his hand at applying plaster.
4. Schedule the cleanup period to allow time for scraping plaster off the frames, returning it to the wheelbarrow, and cleaning up the tools and work area.

Safety Precautions

1. Avoid spilling plaster on your skin or clothing.
2. Do not pour plaster down any plumbing drain.

Homework

Reading 62

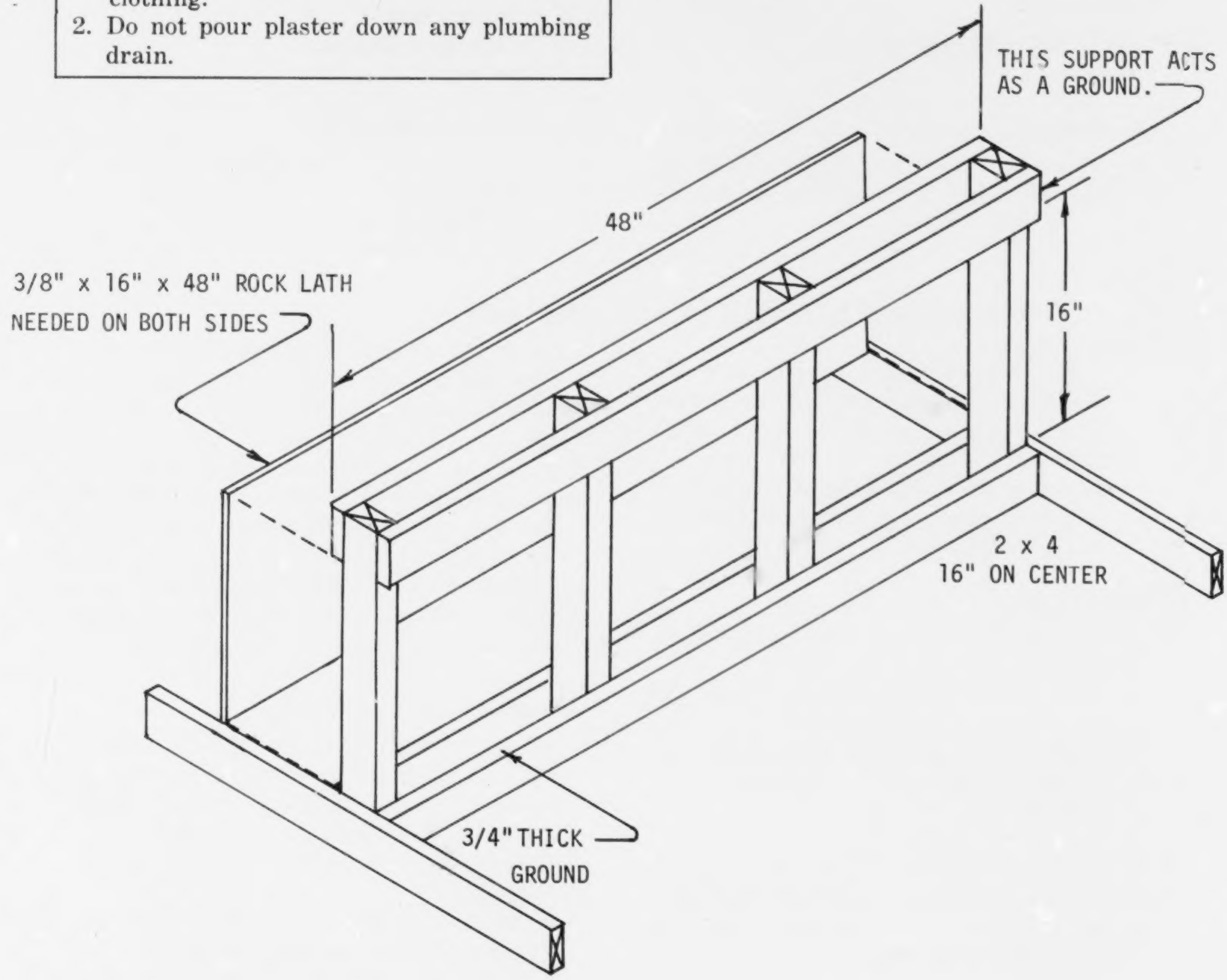

THIS SUPPORT ACTS AS A GROUND.
48"
3/8" x 16" x 48" ROCK LATH NEEDED ON BOTH SIDES
16"
2 x 4
16" ON CENTER
3/4" THICK GROUND

Fig. 119-1. Simulated Wall Frame

ASSIGNMENT 120, UNIT 62

Applying Ceiling Materials

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to applying ceiling materials:
   a. Give reasons why ceilings are installed in buildings and name a few buildings you know of that have rooms with no ceilings.
   b. Describe what can be done if a ceiling in an older home or building develops bad cracks or begins to fall down.

Discussion

2. Given the text reading and a demonstration:
   a. State three reasons why ceilings are enclosed.
   b. Name three types of drywall ceiling materials commonly used in house construction.

Laboratory Activity

3. Given the necessary equipment and supplies, measure, cut, and install furring strips and ceiling tile.

Time Schedule

5 Overview
10 Demonstration
5 Discussion
25 Laboratory Activity

Equipment and Supplies for Demonstration

The teacher will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	claw hammer
1	steel tape
1	framing square
1	utility knife
1	crosscut saw
1	compass saw
1	staple gun/staples
1	screwdriver

Supplies (Group of 5)

2	1″ x 2″ x 45″ furring strips
6	6d box nails
4	12″ x 12″ acoustical ceiling tiles *or*
2	12″ x 24″ tiles

Overview (5)

1. Your text reading discussed ceilings and how ceiling materials are applied.
2. I will demonstrate how to install ceiling tile.
3. I will ask you questions about why ceilings are enclosed and which types of ceiling materials are most commonly used in house construction.
4. In the laboratory activity you will install furring strips and ceiling tile in your structure.

Demonstration (10)

1. Show the students how to measure across the ceiling for furring strips, and how to locate and nail the two furring strips shown in the Laboratory Manual.
2. Demonstrate fitting and cutting the corner tile:
   a. Position a tile in the corner with the tongued edges against the walls.
   b. Mark the tongued edge that lies along the *front* wall.
   c. Lay out and cut 1″ from along this edge.
3. Demonstrate how to apply ceiling tile to a furring strip:
   a. The cut edge is placed at the front wall. One groove edge should then lie directly under Furring Strip B.
   b. Install the tile by stapling to both furring strips.
   c. If necessary, place one nail tight in the corner to hold the tile in place until the trim is installed.

Discussion (5)

Discuss the basic types of ceiling materials, their uses, and advantages.

1. Why are ceilings enclosed? (To limit height. To conceal overhead framing and

utility systems. To control heat and sound. To add beauty.)
2. Which types of ceiling materials are used most commonly in homes? (Drywall materials: plasterboard, tiles, and paneling.)
3. In what form is drywall ceiling material the easiest for the home handyman to apply? (Tile.)

Laboratory Activity (25)

Today the students will nail furring strips to the structure and staple the ceiling tile in place.

1. Distribute equipment and supplies.
2. Caution students to follow directions carefully when they lay out the tile for cutting.
3. Observe and help students as necessary.

Safety Precaution

Use a staple gun only for fastening one piece of material to another. Do not operate it in any other way.

Homework

Reading 63

ASSIGNMENT 121, UNIT 63

Laying Floors

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to laying floors:
   a. Name the material used to cover the floor in your industrial arts laboratory and tell why it is the same or different than the flooring material in rooms in your home.
   b. Count the number of companies in your local telephone directory which specialize in applying flooring materials.

Discussion

2. Given questions related to flooring:
   a. Identify at least five different flooring materials.
   b. Name four basic types of adhesives.
   c. Give a reason why long-wearing floor materials are used in commercial buildings.

Laboratory Activity

3. Given the necessary equipment and supplies, lay vinyl floor tiles.

Time Schedule

5 Overview
10 Lecture-Discussion
30 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	dust brush
1	straightedge (straight piece of wood)
1	mastic applicator
1	snips or utility knife

Supplies (Group of 5)

¼ pt. tile mastic, water-soluble
4 12″ x 12″ vinyl tiles*

* 9″ x 9″ tile may be substituted without sacrificing any basic concepts involved. The use of 9″ x 9″ tile would require one more tile per wall section and necessitate a few

minor changes in the Laboratory Manual instructions.

Overview (5)

1. Your text reading described the various types and uses of flooring materials used in construction.
2. I will discuss with you various flooring materials and adhesives.
3. You will be asked to name floor materials and adhesives which are commonly used today.
4. In the laboratory activity, you will install floor tiles in your structure.

Lecture-Discussion (10)

1. Discuss various materials that are available for flooring: concrete, terrazzo, ceramic tile, wood, resilient materials such as asphalt and vinyl products, and carpeting.
2. State the standard tile sizes as being 9" x 9" and 12" x 12".
3. Discuss the importance of cleaning a floor surface beforehand so the tile will adhere well.
4. Discuss the basic kinds of flooring adhesives: water-soluble paste, asphalt base, waterproof, two-stage concrete, and specialty adhesives.
5. Explain that mastic must always be applied thinly and evenly to prevent it from oozing or forming lumps.
6. Describe the drying of the mastic (finger-touch dry) and the final positioning of the tile.
7. The following questions may be used for review:
   a. What floor materials are commonly used today? (Concrete, terrazzo, ceramic tile and stone, wood, metal, resilient flooring, carpeting.)
   b. What are the basic kinds of flooring adhesives? (Water-soluble paste, asphalt-base adhesive, waterproof adhesive, two-stage concrete adhesive, and specialty adhesives.)
   c. Why are long-wearing floor materials used in banks, business buildings, etc.? (Because of heavy traffic flow.)

Laboratory Activity (30)

Students are to fit and lay four 12" x 12" vinyl floor tiles with mastic.

1. To make salvaging easier, you can have students staple kraft paper to the subfloor. Tile can be laid on top of the paper and later removed with relative ease. (Indicate to the students that this is not a building practice, but for the sake of salvage it is being done in this lesson.)
2. Emphasize the importance of laying out and cutting the tile to fit around the ductwork opening and along the edge of the subfloor *before* mastic is applied.
3. Caution students about spreading the mastic *evenly* and *thinly* over the floor, and then allowing it to dry to finger-touch dryness.

Homework

Reading 64

ASSIGNMENT 122, UNIT 64A

Finishing the Project

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to finishing the project:
   - a. List several tasks that had to be done to *finish out* the construction in your home or your school.
   - b. Give two examples of finishing practices that must be used before a superhighway can be opened to traffic.

Laboratory Activity

2. Given the necessary equipment and supplies, install an interior window casing.

Time Schedule

5	Overview
10	Lecture
5	Demonstration
25	Laboratory Activity

Equipment and Supplies for Lecture and Demonstration

Equipment

1	overhead projector/screen
1	miter box w/saw
1	steel tape

Supplies

1	Transparency 122
1 pc.	2¼" x 8′ teardrop casing, convex face (also called "clamshell")

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	miter box w/saw
1	steel tape
1	1/32" nail set
1	claw hammer

Supplies (Group of 5)

1 pc.	2¼" x 8′ teardrop casing, convex face (also called "clamshell")
12	4d finish nails
12	8d finish nails

Overview (5)

1. Your text reading described the steps taken to finish a project so that the owner may occupy or use the structure.
2. I will tell you who some of the tradesmen are, who did roughing in work, that return to the site to finish the structure. I will also tell you about some of the tradesmen who normally appear on the site for the first time to do finishing work.
3. I will also demonstrate how to cut a window casing using a miter box.
4. In your laboratory activity, you will install window casing on the interior of your structure.

Lecture (10)

Today's lecture will concern some of the tasks involved in finishing a structure. Finishing, in most cases, calls for many of the same tradesmen who did roughing-in work to return to do finishing work. There are some tasks to be done for the first time.

1. Show Transparency 122, Finishing the Structure. Let's look at some of the tradesmen who must return to the site to finish their work.
   - a. Electricians: Install electrical appliances, protective covers, light fixtures, and heating units, etc.
   - b. Plumbers: Install lavatory fixtures, cleaning units, laundry units, water coolers, etc.
   - c. Heating and air conditioning workers: Install heating and cooling units, registers, etc.
   - d. Carpenters: Fit trim, make built-ins, install doors, complete stairs, etc.
   - e. Communications technicians: Install intercoms, telephones, and burglar alarms.
   - f. Sheet metal workers: Install gutters, downspouts, awnings, etc.
   - g. Iron workers: Install railings, fire escapes, etc.
2. Now let's look at some of the jobs that are normally done for the first time.

   Painters: Fill holes; cover defects; apply stains, paints, and varnishes; etc.

   Muralists: Paint pictures on walls and ceilings.

   Mosaicists: Make pictures by inlaying bits of colored stone or glass in mortar.

   Sign painters: Paint signs.

   Paperhangers: Install wallpaper, tex-

tured materials, vinyls, and cloths on walls.
Floor finishers: Lay carpets, polish terrazzo floors, clean and polish wood floors, etc.
Interior decorators: Coordinate colors, fabrics, and furnishings to complete a building.

Demonstration (5)

1. Use this time to demonstrate the miter box and saw the students will be using. Details will vary depending on the type of miter boxes that are available.

Laboratory Activity (25)

1. It is recommended that each student group have one miter box with saw. Students are to begin their finish carpentry.
2. Give help as needed.
3. Supervise the cleanup and return of equipment.

Homework

None

ASSIGNMENT 123, UNIT 64B

Finishing the Project

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given questions:
   a. State two reasons for not using a miter joint at an interior corner when installing trim moldings.
   b. State two reasons why trim pieces are joined at interior corners with coped joints.

Laboratory Activity

2. Given the necessary equipment and supplies, install baseboard, base shoe, and cove molding.

Time Schedule

5 Overview
10 Lecture-Demonstration
5 Discussion
25 Laboratory Activity

Equipment and Supplies for Lecture-Demonstration

Equipment

1	overhead projector/screen
1	miter box w/saw
1	coping saw
1	wood file

Supplies

1	Transparency 123
2 pcs.	½″ x 2¼″ x 12″ baseboard
¼ sht.	abrasive paper (medium)

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	miter box w/saw
1	coping saw
1	½″ round wood file
1	steel tape
1	1/32″ nail set
1	claw hammer

Supplies (Group of 5)

1 pc.	½″ x 2¼″ x 6′ baseboard*
1 pc.	½″ x ¾″ x 6′ base shoe*
1 pc.	¾″ x 6′ cove molding*

1/4 sht. abrasive paper (medium)
* See Fig. 123-1.

Supplies (Class)

1/2 lb. 4d finish nails
1/2 lb. 8d finish nails

Overview (5)

1. I will tell you about the various types of joints that are used for trim.
2. I will also demonstrate making a coped joint.
3. You will be asked to explain why coped joints are used at interior corners and why mitered joints are not used at interior corners.
4. In the laboratory activity, you will continue installing interior trim in your structure.

Lecture-Demonstration (10)

Today students will install trim pieces. For these tasks they will need to be familiar with several kinds of joints. (Point out typical joints around the laboratory: window frames, door frames, baseboards, bulletin boards, etc.)

1. Explain that various types of joints are used for trim work. The choice depends on the type of material and where it is used. See Fig. 123-1. Show Transparency 123-1, Joints, and discuss the five kinds of joints. See Fig. 123-2.
2. Use the baseboard pieces to show the technique of making coped joints.
   a. Make a 45° miter cut.
   b. Saw along the edge of the miter cut with a coping saw, making a slight undercut.
   c. Trim up the coped cut with a wood file if necessary, and sand.
3. Explain reasons for using a coped joint on interior corners.
   a. There is no noticeable gap.
   b. It is an easy technique of installing trim.
   c. An angle other than 90° can be fit with a coped joint.

Discussion (5)

1. Why are trim pieces joined at interior corners with coped joints? (There is no noticeable gap. It is an easy technique of installing trim. An angle other than 90° can be fit with a coped joint.)
2. What are two reasons for not using a miter joint at an interior corner when installing trim moldings? (When one piece is nailed to one wall and the other piece is nailed to another wall, the joint tends to open up leaving a crack. If the molding shrinks, the joint will pull open leaving a crack.)
3. Why is it *not* necessary to use a coped joint at exterior corners when installing molding? (The process of nailing draws one piece of molding tightly against another.)
4. Could a coped joint be made without first cutting a 45° miter on one piece? (Yes,

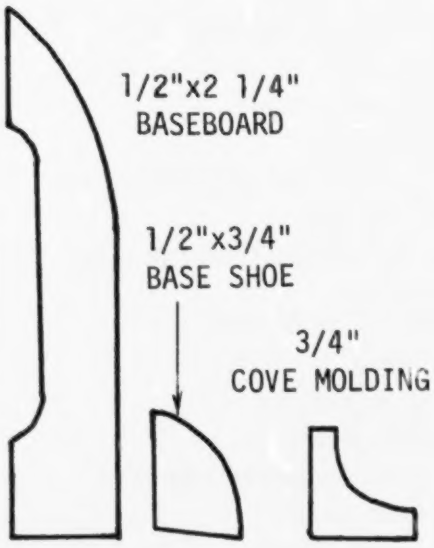


Fig. 123-1. Moldings

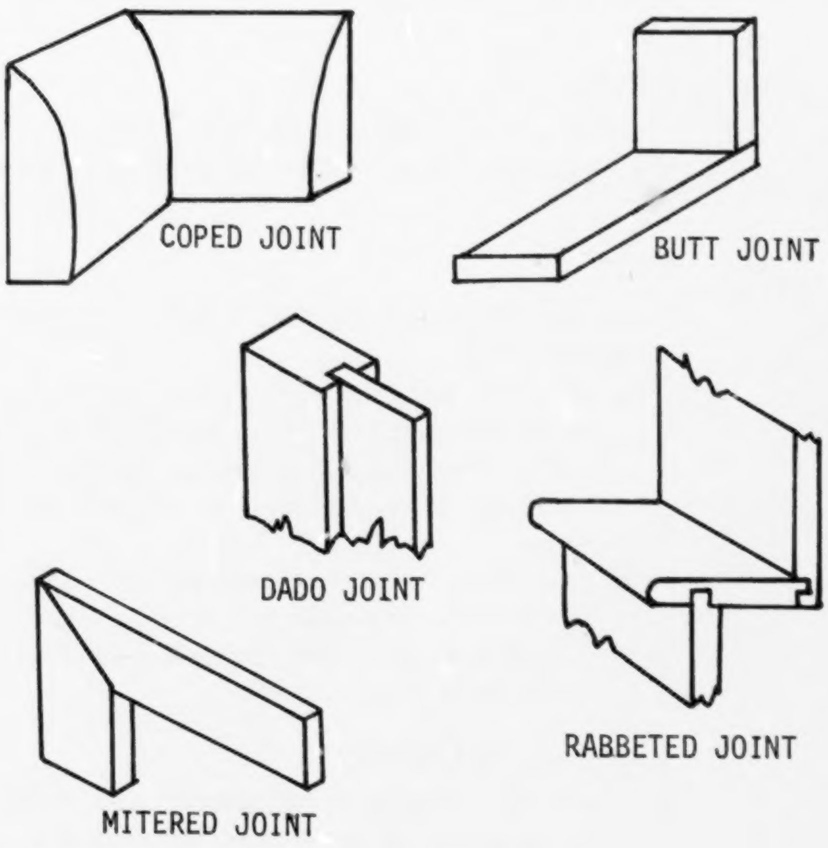


Fig. 123-2. Joints and Trim

by scribing a line or using a profile gauge.)

Laboratory Activity (25)

1. Identify for the students the trim material they will be installing.
2. Have students follow the directions in the Laboratory Manual.
3. Some students can be working on baseboard while others are working on cove moldings.
4. Supervise cleanup and return of equipment.

Homework

Reading 65

ASSIGNMENT 124, UNIT 65A

Painting and Decorating

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to painting and decorating:
    a. Explain in what ways the specifications for paint used to line highways differ from the specifications for paint used on your walls or woodwork at home.
    b. List what fixtures or accessories would need to be installed on a new school playground and new football field with track and field facilities.

Laboratory Activity

2. Given the necessary equipment and supplies, prepare exterior and interior surfaces for painting.

Time Schedule

5	Overview
10	Demonstration
30	Laboratory Activity

Equipment and Supplies for Demonstration

The teacher will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	nail set
1	claw hammer
1	tape knife
1	1½" paint brush (optional)
1	stepladder
1	caulking gun w/compound

Supplies (Per class)

1 can	putty
1 qt.	clear shellac
1 qt.	turpentine
5 shts.	abrasive paper (fine)
	clean rags
1 qt.	methyl alcohol (if brush is used for applying shellac)

Overview (5)

1. Your text reading described that part of finishing known as "painting and decorating."
2. I will tell you about various techniques used to prepare a surface for painting and decorating.
3. In your laboratory activity, you will prepare your structure for painting.

Demonstration (10)

1. Show how to apply putty to cracks and nail holes. Review the need for setting nails. Explain that putty protects wood from moisture and provides a smooth surface for painting.
2. Demonstrate how to load a caulking gun and how to use it around a window opening.
3. Demonstrate priming knots with clear shellac. Explain that this prevents "bleeding" through paint. Use a "wipe on" technique. Call attention to the use of alcohol for cleaning shellac from brushes or any other equipment. *Neither water nor turpentine will dissolve shellac.*
4. Mention the importance of wiping dust and grease from wood surfaces using a clean rag and turpentine. Paint will not adhere to surfaces coated with grease.

Laboratory Activity (30)

Today students will prepare interior and exterior surfaces for painting.

1. Divide each group of students into two crews: three are to work on the exterior and two on the interior.
2. The Laboratory Manual directions for sealing knots suggest alternative techniques: wiping on the shellac or brushing it on. Be sure that students who use brushes clean them promptly.

Homework

None

ASSIGNMENT 125, UNIT 65B

Painting and Decorating

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the necessary equipment and supplies, apply paint to exterior and interior surfaces.

Time Schedule

5 Overview
10 Demonstration
30 Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	bowl or can (to demonstrate tinting paint)
1	paint roller and pan
1	3″ paint brush

Supplies

1 qt.	latex-base paint, white
3 tubes	coloring for latex paint (any colors)

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	flat mixing paddles
2	3″ brushes
2	1½″ brushes
1	paint roller and pan

Supplies (Per class)

*	latex paint—any color
1 qt.	liquid detergent
1 roll	masking tape
	paper towels, newspapers, rags
2	containers for paint (1 lb. coffee cans)

* If two coats of paint are to be applied (Activities 65B and 65C), you will need approximately 1 gal. of interior paint and 1 gal. of exterior paint for every five struc-

tures. Applying the second coat (Activity 65C) is optional.

Overview (5)

1. Yesterday you prepared the interior and exterior surfaces of your structure for painting.
2. I will show you how paint is tinted and demonstrate how to paint with a brush and roller.
3. In the laboratory activity, you will paint the interior and exterior of your structure.

Demonstration (10)

1. Demonstrate tinting paint. Show how to obtain various shades of color by squeezing a quantity of tinting color from the selected tube into white paint in a bowl or can.
2. Demonstrate how to pour paint neatly into a roller pan (or dip it out) and how to use a roller.
3. Demonstrate how to "spot" paint with a brush (lay the brush load of paint in two or three spots, rather than one.)
4. Explain that the latex-base paints used for today's activity can be washed from brushes and rollers with a warm-water detergent solution *if* it is done promptly. Latex-base paint that has dried cannot be washed away with water.
5. Demonstrate how to empty the roller pan and clean pan, roller, and brush.
6. Explain the importance of wrapping and storing brushes in such a way that the bristles will remain straight.

Laboratory Activity (30)

1. Each group of students will again form two crews.
2. Students who prepared the exterior in Activity 65A should paint the interior (Problem 1), and those who prepared the interior should paint the exterior (Problem 2).
3. Instruct students to follow Laboratory Manual directions for Activity 65B.
4. Allow enough time to clean and wash the brushes and put away the equipment and supplies.

Homework

Activity 65C is optional. If it is used, there is no homework. If Activity 65C is omitted, assign Reading 66.

ASSIGNMENT 126, UNIT 65C
(OPTIONAL)

Painting and Decorating

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the necessary equipment and supplies, apply exterior and interior finish coats of latex paint.

Time Schedule

5	Overview
40	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	flat mixing paddles
2	3″ brushes
2	1½″ brushes
1	paint roller and pan

Supplies (Group of 5)

	latex paint from 65B
1 qt.	liquid detergent
1 roll	masking tape
	paper towels, newspapers, rags
2	containers for paint (1 lb. coffee cans)

Overview (5)

1. Yesterday you put a base coat of paint on the interior and exterior of your structure.
2. In today's laboratory activity, you will apply a finish coat of paint.

Laboratory Activity (40)

1. Each group of students will again form two crews.
2. Students who painted the exterior in Activity 65B should paint the interior, and those who painted the interior should paint the exterior.
3. Students should follow the directions for Problem 1 or Problem 2.
4. Allow enough time to clean and wash the

brushes and put away the equipment and supplies.

Homework

Reading 66

ASSIGNMENT 127, UNIT 66A

Installing Accessories

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to installing accessories:
    a. Explain the difference between a fixture and a furnishing, and locate three of each in the room you are now in.
    b. Name what fixtures or accessories would need to be installed on a new playground and a new football field with track and field facilities.

Laboratory Activity

2. Given the necessary equipment and supplies, follow proper procedures in installing a duplex convenience outlet, a porcelain lamp receptacle, and a toggle switch to complete a grounded electrical system in the structure.

Time Schedule

5	Overview
20	Demonstration
20	Laboratory Activity

Equipment and Supplies for Demonstration

The teacher will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow. He will also need two lengths (scrap pieces) of T.W. wire. *Make up a dummy outlet box prior to class* that resembles those in the students' structures.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1 pr.	long-nose pliers
1 pr.	electrician's pliers
1	wire stripper *or* electrician's knife
2	screwdrivers

Supplies (group of 5)

1	parallel ground duplex receptacle w/cover plate
1	single-pole toggle switch w/cover plate
1	keyless porcelain lamp receptacle
1	solderless connector, for No. 16 wires
2	metal ground clips

Overview (5)

1. In your reading you learned that when a structure can be locked or guarded, accessories and fixtures are usually installed. This includes such things as electrical and communications fixtures; heating, cooling and air conditioning fixtures; plumbing fixtures; and various hardware items.
2. Today I will demonstrate some procedures for installing electrical fixtures.
3. You will then follow the procedures demonstrated to install two receptacles and a switch.

Demonstration (20)

A logical sequence of demonstrations is suggested here with some pertinent comments.

1. Strip wires. Caution students to avoid nicking wire or removing too much insulation: ½″ to ¾″ is enough.
2. Form loop on end of wire.
3. Connect wire to terminal. The loop should go around the terminal in a clockwise direction so the loop will tighten as the screw is drawn down. All bare wire should be covered by head of screw.
4. Install ground clip and fasten ground wire to it.
5. Twist wires together and fasten with solderless connector. Caution students to be sure all bare wires are covered by the connector.
6. Push excess wire into box, avoiding sharp kinks.
7. Fasten an outlet or switch to the box.
8. Install a cover plate.

Laboratory Activity (20)

1. Plan some division of tasks so that group members are not crowding each other.
   a. You may assign some students to work on the duplex outlet while others are installing the toggle switch.
   b. You may prefer to have one student strip wires, one form loops, one connect wires to terminals, etc.
2. Observe and give help as needed.
3. Inspect each receptacle connection before students push the fixture into the outlet box.

Safety Precautions

1. Avoid cutting yourself when stripping wires.
2. Use caution when tightening electrical terminals; avoid puncturing your hand if the screwdriver should slip.

Homework

None

ASSIGNMENT 128, UNIT 66B

Installing Accessories

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the necessary equipment and supplies, connect a grounded (3-prong) male plug to the electrical system.

Time Schedule

5 Overview
10 Demonstration
30 Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	wire stripper
1 pr.	long-nose pliers
1	screwdriver

Supplies

3	lengths of scrap wire (one each: black, white, green)
1	3-prong male plug

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1	wire stripper *or* electrician's knife
1 pr.	long-nose pliers
1	screwdriver

Supplies (Group of 5)

1	3-prong male plug
1	60-watt, 120 V light bulb

Equipment for Inspection (Per teacher)

1	extension cord
1	fuse assembly (5-amp. size, is recommended.)

Overview (5)

1. You have installed some electrical fixtures in your structures. You should understand that other types of fixtures

would also normally be installed. These would generally include communications fixtures, plumbing fixtures, hardware, and others.

2. I will show you how to put a grounded plug on the electrical supply line of your structure so we can activate the electrical system.
3. During your laboratory activity, you should first complete any work that you did not finish during your last class period. Then you are to connect a 3-prong male plug. When those things are finished, we will test your electrical system.

Demonstration (10)

The preparation of the wires is the same as for the previous activity.

1. If problems were encountered, some solutions to those problems should be offered.
2. Demonstrate how a male plug is connected to a grounded system.

Laboratory Activity (30)

1. Give assistance as needed, especially to those groups that are farthest behind.
2. As each electrical system is completed, including the male plug, test it by inserting the 120-volt light bulb and throwing the switch. It is suggested that you make up a low-amperage fuse assembly for testing purposes.

Safety Precaution

Use caution in testing electrical systems. Shocks and burns can be serious.

Note: See Assignment 129, Laboratory Activity, items 2d and 2e.

Homework

Reading 67

ASSIGNMENT 129, UNIT 67

Completing the Site

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given a situation related to completing the site, make a drawing (plan view) of your home or school site and locate and label accesses, exterior features such as patios and fences, plantings such as trees or bushes, and other objects or features that were placed there when the site was completed.

Discussion

2. Given a text reading and lecture:
    a. State three ways in which plants are useful.
    b. Describe the job of a landscape architect.
    c. Explain why and how a plant's root system is protected during transplanting.

Laboratory Activity

3. Given the necessary equipment and supplies, prepare soil and properly plant a tree, shrub, or other plant appropriate to your area.

Time Schedule

5 Overview
15 Lecture-Discussion
25 Laboratory Activity*

* Most states designate a day in April or May as Arbor Day; many schools observe this day with tree planting activities. Administrative personnel at your school might want to explore with you the possibility of letting your students carry out Laboratory Activity 67 on or near Arbor Day. Your local newspaper may also be interested in students' tree planting activities on Arbor Day.

Equipment and Supplies for Laboratory Activity*

Equipment (Class) (typical)

1	round-nose shovel
1	rake
1 pr.	wire cutters

1 pr.	slip-joint pliers
1	hammer

Supplies (Class) (typical)

1	small tree or shrub
20 lb.	peat moss
10 lb.	"10-6-4" fertilizer
2	1" x 2" x 6' stakes
2'	garden hose
6'	wire

* Varies according to laboratory activity chosen.

Overview (5)

1. Your reading explained that completing the site includes providing access such as roads, drives, and sidewalks; building exterior features such as fences and patios; sloping and finishing the earth; putting in appropriate plantings; and giving the site its final cleanup.
2. I will tell you more about landscaping, and we will discuss some of the reasons for providing plant life at a construction site.
3. (If it applies to the teacher's plan for the day)—In the Laboratory Activity, you will prepare the soil and complete a planting.

Lecture (15-45)*

*__Note:__ This lecture is organized in three sections. *The instructor may delete or shorten any section to allow more time for a Laboratory Activity.* If there is to be no activity, the entire period may be spent on lecture and discussion.

Completing a site involves several kinds of work. Finish work may include roads and walks; fences; leveling or sloping the earth; planting trees, shrubs, and lawns; and cleaning up the whole site. Some of these activities are described in detail in the text reading, or in other parts of this course. Today's lecture concerns plants or "vegetation": why plants are useful and what the reputable contractor does to provide healthy, useful plant life at the site.

Part I. Why Plants are Useful

1. Living trees are valuable in several ways.
   a. Their leaves provide shelter from direct sunlight in summer so they help keep buildings from growing extremely warm.
   b. Some trees, especially evergreen trees, break the force of winter winds that otherwise would rob buildings of heat.
   c. During their growing season, trees add valuable oxygen to the air.
   d. They provide food and nesting places for birds and other wildlife and help hide them from their enemies.
   e. They help control flooding during heavy rains and help store the rainwater in the ground for future use.
   f. They screen out some of the noise from busy highways.
2. Americans used to take trees for granted. The first settlers along our Atlantic coast found thick forests. Soon they began to cut down trees to build their homes, ships, and forts. As the pioneers moved westward, more and more trees were used for lumber. Countless other trees were destroyed to clear land for homes, farms, highways, and railroads. By 1900 most of our original forests were gone.
3. As the demand for lumber, paper, and other lumbering products has grown greater and greater, America's forest lands have shrunk. Private citizens, corporations, and the federal government have taken some steps to reestablish woodlands for lumbering, and to protect the trees that remain in public parks. However, the trees on most private land are not protected by laws. This makes it especially important for people who develop a construction site to understand the value of *living* trees.
4. Grass, shrubbery, and other plants also are useful in several ways. The ability of plants to hold rainwater on the land is one of their most important properties. Raw earth beside a new building, road or dam will turn into mud when it rains, and wash away. Mud not only is a nuisance, it can be dangerous, especially on a road. When the earth is covered with well-rooted grass or other thick, healthy plant life, most rainwater slowly soaks into the earth, and the water that runs off is not muddy.
5. Many plants are useful for other reasons too.
   a. They eliminate the nuisance of dust blowing from the surface of dry earth.
   b. They prevent undesirable weeds such

as thistles, crabgrass, and poisonous plants from getting established.

   c. They are important in outdoor recreation and dining areas.
   d. Some plants provide protection from extremes of heat and cold, and most plants add beauty to the site.

6. Have students name three ways in which plants are useful. (Shade, shelter for wildlife, windbreak, manufacturing materials, prevention of erosion.)

Part II. The Contractor, the Owner, and the Landscape Architect

1. While a construction project is still in the planning stage, some decisions are made that can affect the plant life at the site for many years. In particular, the need for trees and topsoil should be discussed during planning.
2. Bare land, left alone, may eventually produce trees, but this process takes generations. A tree tall enough to shade a house may have been growing for a hundred years! Therefore if there are living trees at a site before construction begins, the landowner, architect, and contractor should consider very carefully which trees can and should be preserved. The contractor then arranges for temporary barriers to protect the root systems and trunks of these trees during construction.
3. Another valuable resource that may exist at a site before construction begins is the topsoil—the thin layer of earth that will support plant life. Below the topsoil there will be clay, sand, or perhaps gravel. When a site is to be excavated, the careful contractor will have the topsoil scraped off and collected. This same topsoil should be spread back over the site when construction is complete. The topsoil belongs to the landowner, and the construction contractor should protect his interest.
4. Even though the trees and topsoil belong to the landowner, saving them during construction causes the contractor some expense and inconvenience. He can expect to be paid a fair amount for protecting trees and stockpiling topsoil.
5. As soon as possible after a structure is completed, the contractor should arrange to have all bare earth covered with suitable plant life. To do this he may call in a landscape architect who specializes in choosing suitable plants for particular locations.
6. The various parts of a construction site may require different kinds of plants. In large, open areas some kind of grass often is started, either by sowing seed or by laying sod. On steep slopes and in shady areas, other low-growing plants (called "ground cover") are planted. If an attractive appearance is important, shrubbery and flowering plants may be carefully chosen and set along the edges of walks, fencelines, or walls. Trees may be planted to give shade, break the wind, or provide shelter for song birds.
7. The landscape architect should know something about the special needs of different plant species and their habits, or ways of growing.
   a. Many kinds of grass grow only in strong sunlight; a few kinds will grow under trees.
   b. Some beautiful kinds of shade trees are easy to grow, but they send their roots into drain tiles and eventually clog up the drainage system. Such trees may be chosen to grow beside a pond or stream, but they should not be planted near drain tiles.
   c. Some of the most beautiful roses and other flowering plants require frequent spraying or dusting with chemicals to protect them from diseases.
   d. Some plants are suitable for planting under a first-floor window, because they will never grow tall. Other very similar plants grow into tall shrubs after a few years, so they would shut out the daylight if they grew in front of windows.
   e. These are the kinds of special knowledge needed to plan and direct landscaping.
8. The landscape architect also considers overall appearance and attractiveness. In northern climates especially, this often means including some plants that stay green in cold weather.
9. Landscape architects may be called on to plan and direct both large and small jobs: one home, a tract of homes, a highway, a dam, a bridge, or a large factory.
10. Have students describe the job of a landscape architect. (Plans and specifies

the plantings and their location to restore the construction site to a natural state.)

Part III. Planting and Growth

1. After a structure is completed, the rough grading is done. This gives the land a shape and contour that provide drainage away from the structure. Then large bushes and trees are set out. The locations of other planting areas are marked.
2. The finish grading is done next. Where plants are to grow, topsoil is spread. Some hand raking and rolling may be needed, to give a smooth, gradually sloping surface. As part of this stage, fertilizers, peat moss, or other soil conditioners may be added to the soil to help prepare it for supporting plant life. Some plants require much more soil preparation than others to get them established and encourage their growth and long life.
3. Plants that grow to full size in one or two years may be started from seed planted at the site. Plants that grow slowly—trees, flowering shrubs, and bushes—usually are transplanted. That is, they are carefully removed from a nursery or greenhouse, where they have been growing, and planted at the construction site.
4. To keep a plant alive when it is moved to a new location, its life system must be disturbed as little as possible.
    a. Minerals and water are taken in by a plant through its roots. During the growing season, this nutrient solution moves upward, through the trunk or stem and the branches to the leaves.
    b. There, through the action of the sun, the leaves manufacture new cell materials for the plant's continued growth and strength.
    c. Some of these cell materials move back down through the branches and the stem or trunk to the root cells.
    d. In transplanting, the plant's living cells must be disturbed as little as possible. The cells at the tip ends of roots and those just under the bark are especially sensitive. If many of the small, thin "root hairs" of a plant are torn off, it is likely to die.
5. One way to protect roots during transplanting is to dig up a single ball of dirt, surrounding the whole root system, and hold it together tightly with burlap. It is also possible to transplant very young trees and bushes with bare roots, but only during certain seasons.
6. At the site, a hole should be dug deep enough to take the ball of earth, and a little wider than the ball. The extra space is filled with soil mixed with fertilizer and peat moss so the roots will have soft, nourishing earth to penetrate during the first few years of life after transplanting.
7. The top of the root ball must be level with the surrounding ground: that is, the trunk or stem should be exposed above the ground just as far as it was before transplanting. If the roots are covered too deeply, the plant will be smothered. If planted too shallow, the roots will be exposed to drying, and the plant may die from lack of moisture.
8. If the root ball was wrapped, the burlap is pulled back from the top and partly down the sides of the ball before the hole is filled in. This will permit rain or water from a hose to penetrate the top of the ball and reach the plant roots. It is not wise to remove the burlap completely: this might damage the ball of earth and disturb the fine feeding rootlets. The burlap that remains under the ball will eventually rot away.
9. After the tree or shrub is in place, the earth is filled gradually. The soil is watered repeatedly during backfilling, so there will be no air pockets around the ball. A low mound of earth is built around the rim of the hole. This forms a saucer to catch and hold rainwater over the root system.
10. Then the surface is mulched with loose, fibrous organic material, to hold water and keep the soil beneath it soft, moist, and cool. Otherwise the sun might bake the soil hard, drying out the root system.
11. After planting, the soil around a root ball is loose. The roots have not yet grown into the surrounding soil. At this time a tree is in danger of blowing over in a high wind. Stakes and wires are often used to support the newly planted

tree. (See Fig. 67-1 in Laboratory Manual.)

   a. A small tree is braced with one stake, driven through the earth beside the ball into firm soil underneath. The trunk, quite high up, is wired to the stake. For a larger tree, two or three stakes may be needed.
   b. The wires must be covered to avoid cutting the bark of the trunk. Short sections of rubber or plastic hose often are used; the wire is run through the hose which can safely be placed in contact with the trunk. The wires and stakes hold the tree firmly in place.
   c. In about two years, the supports can be removed. The tree will have adapted itself to its new location and will not blow over.

12. Have students explain why and how a plant root system is protected during transplanting. (See items 5-8.)

Laboratory Activity (25)

1. Adapt the laboratory activity and planting techniques to fit your situation.
2. If your students will not be able to plant trees, one of these alternate activities might be appropriate:
   a. Plant a shrub, bush, or climbing vine.
   b. Use soil trays to start experiments with various types of grass seed.
   c. Tour the school grounds to analyze the landscaping plan and details.
   d. Let the students examine magazines showing a variety of landscaping ideas. (If this is planned in advance, some students may be able to bring in suitable house and gardening magazines.)
   e. Invite a landscape architect or professional gardener to speak.

Homework

Reading 68

ASSIGNMENT 130, UNIT 68

Transferring the Project

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Give information related to transferring the project:
   a. Tell when a project is *closed* and what this means to the contractor and owner.
   b. Give some examples of *punch list* items for a new highway and a new house.

Laboratory Activity

2. Given the necessary equipment and supplies, complete a punch-list form, a warranty form, and a release form.

Time Schedule

5 Overview
20 Lecture
20 Laboratory Activity

Overview (5)

1. Your text reading told you that transferring the project from contractor to owner involves making inspections and correcting mistakes, release of claims and liens, providing warranties, and final payment.
2. I will tell you about the inspection team and the purposes of inspections. I will also explain the other activities involved in transferring the project.
3. In the laboratory activity, you will record on a punch list any corrections that must be made before the owner will accept your construction project. You will also complete a contractor's warranty form and a contractor's release form.

Lecture (20)

Today I will explain the four main activities involved in transferring a project: (1) inspecting, (2) signing releases, (3) providing warranties, and (4) receiving final payment.

1. **Inspections**
    a. A completed project is inspected to determine whether the quality meets the standards stated in the contract. This involves inspecting workmanship and materials.
    b. The inspection team represents people and organizations that have a direct interest in the project. The contractor and architect-engineer will want an inspection to protect their professional reputation. The owner wants to know that he is getting what he pays for.
    c. Whatever the inspection team finds that must be corrected is called a "deficiency" and is recorded on a "punch list."
    d. The contractor's job is not finished until all deficiencies (mistakes) are corrected.
2. **Releases**
    a. When a contractor signs a *release,* he is stating that he does not have any claims or liens against the project. That is, he has been paid according to the terms of the contract and cannot demand any additional payment in the future.
    b. A *lien* against a property is a legal document. It is issued by a court to a contractor, subcontractor, supplier, or craftsman who has not been paid for his services or goods which were included in the contract.
    c. In order for the owner to have a lien against his property removed, he must satisfy the demands of the court. In extreme cases he may have to turn the title of the property over to the contractor. Therefore, the owner wants to be assured that there are no liens before he gives the final payment to the contractor.
3. **Warranties**
    a. The contractor's *warranty* is his promise that the project is free from defects in materials or workmanship, or that he will correct any defects during a specified period of time.
    b. Manufacturers or suppliers of products used in the project may also "warrant" the quality of their products; for example, roofing, water heater, or any built-in appliances.
4. **Final Payment**
    a. The contractor receives final payment when he has: (1) corrected all deficiencies, (2) presented releases of claims and liens, and (3) presented warranties and operating manuals.
    b. When the owner makes final payment, he assumes full responsibility for the project. He should be fully ready to "take over" his new obligations. For example, he will probably have arranged for a fire insurance policy, which will start protecting him as soon as the structure is turned over to him. He may also have made arrangements with utility companies so that electricity, water, fuel gas, and telephone service will be provided immediately.

Laboratory Activity (20)

The activity today involves transferring the project to the owner. The students play the role of a contractor. The instructor assumes two roles: the inspector and the owner.

1. Using the Inspection Checklist in the Teacher's Guide, the instructor will evaluate each structure in each class. See Fig. 130-1.
2. The "contractors" are to watch and listen as the "inspector" evaluates each item on the checklist and offers comments about the quality of workmanship.
3. As you complete the inspection of a structure, note the deficiencies on a copy of the Punch List Form found in the students' Laboratory Manuals. You will need to write in only one student's Laboratory Manual concerning each structure. The other students in that group will copy the deficiencies onto the Punch List Charts in their Laboratory Manuals.
4. After the inspection, each student will sign a release (in the Laboratory Manual), giving up any claims or liens against the structure.
5. Each student will also sign a warranty (in the Laboratory Manual) which guarantees workmanship and materials for one year.
6. If no deficiencies are noted, the owner (instructor) will assume full responsibility for the structure by giving the students the final payment (the grade).
7. If there are deficiencies, the final payment will take place during the next laboratory period after all deficiencies are corrected.

Homework

Reading 69

INSPECTION CHECKLIST FOR WOOD FRAME STRUCTURE Y = Yes (Approved) N = No (Not approved)

	Class 1					Class 2					Class 3					Class 4					Class 5					Class 6				
Group:	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
INTERIOR																														
Walls																														
Gypsum wall surfaces																														
Plywood paneling																														
Baseboard and shoe																														
Window casing																														
Paint																														
Ceiling																														
Acoustic tile																														
Ceiling molding																														
Floor																														
Floor tile																														
Electrical Power System																														
Convenience outlet																														
Lamp outlet																														
Toggle switch																														
Heating & Cooling System																														
Air duct installation																														
EXTERIOR																														
Roof																														
Shingles																														
Metal rake edge																														
Soffit																														
Fascia and drip edge																														
Paint																														
Front																														
Horizontal clapboard																														
Window frame																														
Glass installation																														
Paint																														
Side																														
Vertical siding																														
Paint																														

Fig. 130-1

ASSIGNMENT 131, UNIT 69

Servicing Property

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to servicing property:
    a. Explain how postprocessing differs from processing and tell why postprocessing is important in construction.
    b. List several servicing activities that should be carried out to improve the condition of a street, highway, or bridge in your community.

Laboratory Activity

2. Given the necessary equipment and supplies, perform needed servicing activities on their structure as determined by a prior inspection.

Time Schedule

5 Overview
15 Lecture
25 Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1 filmstrip projector/screen

Supplies

1 Filmstrip 131

Equipment and Supplies for Laboratory Activity*

*Varies according to needs, as determined during the inspections of the previous day.

Overview (5)

1. Your reading explained that servicing of property or "postprocessing" consists of five kinds of activities:
    a. Operating
    b. Maintaining
    c. Repairing
    d. Altering
    e. Installing
2. You will see a filmstrip today showing several specific activities which fit into each of the five general servicing categories.
3. In the laboratory activity you will be performing the servicing tasks determined necessary by yesterday's inspection.

Lecture (15)

Today's lecture concerns servicing practices.

1. If a structure is to serve the purpose for which it was built, certain activities must be carried on. We call these activities "servicing" or "postprocessing."
2. Servicing includes five groups of activities: operating, maintaining, repairing, altering, and installing.
3. The filmstrip you are about to see shows several examples of each kind of servicing activity. (Show Filmstrip 131 and read or paraphrase the lecture script.)

Script for Filmstrip Lecture: Servicing Activities

Frame 1: Focus
Frame 2: Filmstrip 131
Frame 3: The World of Construction
Frame 4: Servicing Activities
Frame 5: *Operating activities* are of two kinds: running or supervising equipment and protecting the project. Here a lock operator is opening the flow gate at a sewage-disposal plant.
Frame 6: Technicians are charging the atomic reactor at an electric power plant.
Frame 7: An operator checks the control panel at an automatic cement-mixing plant.
Frame 8: A production operator checks the control plan at a copper-ore processing plant.
Frame 9: Technicians are checking the operation of a television studio.
Frame 10: This is the operating and control center of an atomic electric-power plant.
Frame 11: A guard protects snow-removal equipment from traffic flow at a state university.
Frame 12: *Maintenance activities* involve the routine housekeeping and

groundskeeping of the project. This man is cleaning a roadside drainage ditch.

Frame 13: Sweeping a city street is a maintenance activity.

Frame 14: Cutting underbrush overhang and removing loose rocks helps to prevent landslides and rock slides.

Frame 15: Patching cracks in the concrete on this overpass helps maintain the surface.

Frame 16: Preventive maintenance work on a railroad involves replacing ties.

Frame 17: This chimney collapsed due to lack of proper maintenance practices.

Frame 18: *Repair activities* involve fixing and replacing elements of the structure or its equipment. Replacing a railroad bridge span is an example.

Frame 19: Removing cracked concrete road surface sometimes is necessary.

Frame 20: This playground surface is being repaved.

Frame 21: Replacing fill and asphalt surface of the shoulder are part of road repair.

Frame 22: A broken sewer-line section must be replaced.

Frame 23: *Altering activities* involve changing the structural form of a project. Adding onto an existing sidewalk is considered alteration.

Frame 24: Closing up window space is a common way of altering.

Frame 25: This wall is cut to provide a large door opening.

Frame 26: Every year many roadways are widened.

Frame 27: *Installing activities* involve placing new equipment in a structure: for example, the installation of more electric wires after a bridge is completed.

Frame 28: Installation of this telephone conduit was needed to increase telephone service to a new housing development.

Frame 29: An air receiver is being installed.

Frame 30: New pipe work is a frequent kind of installation.

Frame 31: A condenser is going into an electricity power plant.

Frame 32: The end.

Laboratory Activity (25)

When the structures were inspected, some deficiencies were noted. The students are to correct these deficiencies today.

1. Have students check their Punch Lists Form, Chart 68-1, completed in Activity 68 to remind them of the corrections needed. Point out that they will be performing repair and maintenance services.
2. Help them determine the equipment and supplies they will need to complete the servicing activities.
3. The groups' foremen are to be responsible for deciding which members of their groups will do the various jobs.

Homework

Reading 70

ASSIGNMENT 132, UNIT 70

Building Dams (Salvaging)

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to building dams:
   a. Tell how a dam affects your life.
   b. List some of the services provided by a multipurpose dam.

Discussion

2. Given a series of questions:
   a. Identify the major occupations involving dam building.
   b. Identify the major types of dams.
   c. Identify some primary and secondary functions of a dam.

Laboratory Activity

3. Given the problem of salvaging a wood frame structure, together with necessary equipment and a checklist, remove and salvage:
   a. Electrical fixtures and parts.
   b. Interior and exterior trim.
   c. Horizontal exterior siding.

Time Schedule

5 Overview*
5 Lecture*
5 Discussion*
30 Laboratory Activity

*Optional: Film on Dam Building replaces these segments.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	screwdrivers
3	claw hammers
2	nail claws *or* ripping chisels
1	putty knife (if window glass was used)

Overview (5)

1. Today's reading assignment explained the purpose of dams, materials used, who builds dams, planning and design, land acquisition, and construction.
2. I will tell you about some purposes and uses of dams and about the people who build them.
3. You will be expected to answer questions about some reasons for dams, the major types of dams, and what occupations are needed to build dams.
4. During the laboratory activity, you will salvage the electrical switches and receptacles, interior and exterior trim, and the exterior siding on your structure.
5. The number of pieces of each part being salvaged will be entered on a chart in your Laboratory Manual. Then the parts will be checked in to me before going to storage.

Lecture (5)

Today the teacher may either review the material covered in the text or show an appropriate film.

1. Explain several main purposes and uses of dams:
   a. To hold or store water by forming a reservoir.
   b. To regulate the flow of water for flood control, for maintaining river traffic (navigation), or for moving treated sewage waste.
   c. To supply falling water for hydroelectric power plant.
   d. To supply water for recreation.
2. Explain possible secondary purposes:
   a. Supplying water for recreation.
   b. Providing a roadway across a stream.
3. Refer to any existing dams in your area. Identify the type of each (earth fill or concrete), and dicuss their uses.
4. Identify some of the occupations that are involved in dam building: operating engineer (equipment operator), carpenter, ironworker, engineer, contractor, and laborer.

Discussion (5)

1. Name some of the occupations that are involved in dam building. (See item 4 above.)
2. What are the major types of dams? (Earth fill and concrete).
3. What are some of the primary purposes for building a dam? (To hold or store water by forming a reservoir. To regulate the flow of water for flood control, for maintaining river traffic (navigation),

ACTIVITY 70
SALVAGE CHECKLIST
(Glass, electrical fixtures, trim, and horizontal siding)

	Class 1					Class 2					Class 3					Class 4					Class 5					Class 6					Total
Group:	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
SALVAGED PART																															
Window glass																															
Cover plate, - switch																															
Cover plate, - duplex																															
Lamp receptacle																															
Toggle switch																															
Duplex receptacle outlet																															
Male plug																															
Heating duct register																															
Ground clips (2)																															
Cove molding																															
Base shoe																															
Window trim (inside)																															
Acoustic tile																															
Furring strips																															
Quarter-round molding																															
Horizontal siding																															
Starter Strip																															

Fig. 132-1

or for moving treated sewage waste. To supply falling water for hydroelectric power plant.)

4. What are some secondary purposes? (Supplying water for recreation. Providing a roadway across a stream which may be used instead of a bridge.)

Laboratory Activity (30)

Today the students are to start "clearing the site" by dismantling the wood frame structures. They are to salvage, clean, and store all reusable materials.

1. Explain to students that they are clearing the site to prepare for new construction which will be the next unit. (This activity gives more realism to site clearing than the clearing problems in the first semester.)
2. Emphasize the importance of salvaging the material where possible.
3. Students are to follow the sequence given in Chart 70-74-1 in the Laboratory Manual for salvaging a portion of the wall section.
4. Explain to students that the interior of a building is usually salvaged first, and then the exterior.
5. To complete the salvaging tasks in the limited class time, each group will be divided into two work crews. Two students are to work on the inside while the other three work on the outside.
6. Explain that the students will check off the material in the Laboratory Manual as it is salvaged, and check it in with the instructor for storage. See Fig. 132-1. The checklist provided may need to be revised to fit particular needs.
7. Emphasize safety at all times, especially the removal of nails from all materials whether they are to be reused or discarded.
8. Students are to clean and store the reusable materials and dispose of the rest, as directed by the teacher.
9. Salvage and site clearing activities will continue for four more days.
10. Demonstrate briefly the correct procedure for removing nails from boards using a nail claw and a hammer.
    Note: It is recommended that you fill out the master checklist in the Teacher's Guide. This will serve two purposes: (1) provide a way to check each group's salvaging activities; and (2) provide an accurate inventory for future use.

Safety Precautions

1. Before laying a board down, be sure there are no nails sticking up.
2. Pull nails carefully from building materials: protect yourself and others.

Homework

Reading 71

ASSIGNMENT 133, UNIT 71

Bridge Building (Salvaging)

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to bridge building:
    a. Determine whether or not it is easy to travel around your community without crossing a bridge.
    b. List some human activities that could not go on in your community or state without the use of bridges.

Discussion

2. Given a series of questions:
    a. Identify the major occupations involved in bridge building.
    b. Identify the major types of bridges.
    c. Identify the major materials that are used for bridge building.

Laboratory Activity

3. Given the necessary equipment and a checklist, continue removing and salvaging:
    a. Shingles and building felt from the roof.
    b. Rake and return fascia.
    c. Fascia and soffit.
    d. Vertical siding.
    e. Building felt from exterior walls.

Time Schedule

5 Overview*
10 Lecture*
5 Discussion*
25 Laboratory Activity

* Optional: Film on Bridge Building replaces these segments.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	screwdrivers
3	claw hammers
2	nail claws

Overview (5)

1. Your text reading explained who builds bridges, materials used, types of superstructures, the planning and designs of bridges, and types of substructures for bridges.
2. I will tell you more about types of bridges and the kinds of work needed to build them.
3. I will tell you about some of the bridges in our local area.
4. You will be asked questions about who builds bridges, kinds of bridges, and the main materials used in bridge building.
5. During your laboratory activity, you will continue to salvage materials. You will remove and store the roof materials and the exterior vertical siding.

Lecture (10)

Today the teacher may either review the material covered in the text or show a film.

1. Explain who builds bridges and some of the occupations involved in bridge building: ironworker, operating engineer, carpenter, cement finisher, laborer, cable spinner, painter, electrician, etc.
2. Describe briefly the three basic kinds of bridge superstructures, and mention examples.
    a. Fixed bridge superstructures
        1) Reinforced concrete slab
        2) Precast concrete slab
        3) Steel beam or girder
        4) Trusses
        5) Arcs
        6) Cantilever
        7) Suspension
    b. Movable bridges
        1) Bascule
        2) Lift
        3) Swing
    c. Temporary Bridges
        1) Wood
        2) Floating
3. Identify the major materials that are used for bridge building: steel, concrete, masonry, and wood.
4. Introduce some facts about bridges in your locale or state.

Discussion (5)

1. Name some occupations involved in bridge building. (Ironworkers, carpenters, weld-

ACTIVITY 71
SALVAGE CHECKLIST
(Roofing, building felt, vertical siding)

	Class 1					Class 2					Class 3					Class 4					Class 5					Class 6					Total
Group:	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
SALVAGED PART																															
Corner board																															
Shingles																															
Starter strip																															
Building felt (roof)																															
Fascia																															
Rake and drip edge																															
Soffit																															
Vertical siding																															
Building felt (wall)																															

Fig. 133-1

ers, cable spinners, painters, electricians, riveters, operating engineers, mechanical engineers, draftsmen, surveyors, etc.)

2. Name three basic kinds of bridges. (Fixed, movable, and temporary.)
3. What materials are used in large quantities for building bridges? (Steel, concrete, masonry, and wood.)

Laboratory Activity (25)

The students are to continue clearing the site (dismantling the wood frame structure.) They are to salvage, clean, and store all reusable materials.

1. Students are to follow the sequence given in Chart 70-74-2 in the Laboratory Manual for salvaging shingles, building felt, fascia and soffit, rake and return fascia, and vertical siding.
2. Students are to salvage, clean, and store all reusable materials and dispose of the rest. (Possible grouping: two students remove materials, two students clean materials, one student checks in the materials to the teacher and stores the reusable materials.)
3. Check off the materials returned by each group before they are stored. See today's checklist, Fig. 133-1.

Safety Precaution

Do not allow a dropped roofing nail to remain on the floor.

Homework

Reading 72

ASSIGNMENT 134, UNIT 72

Road Building (Salvaging)

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to road building:
   a. Describe how your life would be changed if there were few or no roads in your community.
   b. Describe how the Interstate Highway System has affected your life or the lives of your parents.

Discussion

2. Given a series of questions:
   a. Name several major occupations involved in road building.
   b. Name several major materials that are used for road building.
   c. Name three kinds of substructural systems of road construction.

Laboratory Activity

3. Given necessary equipment and a checklist, continue removing and salvaging:
   a. Roof sheathing.
   b. Window unit.
   c. Exterior wall sheathing from front and sides.
   d. Interior paneling and drywall pieces.
   e. The plumbing system.

Time Schedule

5 Overview*
10 Lecture*
5 Discussion*
25 Laboratory Activity

* Optional: Film on Road Building replaces these segments.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	standard screwdrivers
3	claw hammers
2	nail claws
1	3/32" nail set

1	pipe vise (for breaking joints of galvanized pipe)
2	pipe wrenches (for breaking joints of galvanized pipe)
1	propane torch (for breaking joints of copper tubing)

Overview (5)

1. Your reading explained how a road is planned and what must be considered during the process of construction from start to finish.
2. I will tell you about procedures used in planning and constructing a highway.
3. You will be expected to name some of the occupations involved in road construction, answer questions about three kinds of substructural systems, and name the main building materials used in road construction.
4. During the laboratory period, you will salvage from your structure: roof, sheathing, front and side wall sheathing, window trim, the window unit, paneling, drywall pieces, and plumbing system parts.

Lecture (10)

1. Review with the students the story of U.S. Highway 54 in central Kansas, as told in the text reading.
2. Refer to local highway construction sites.
3. Have students help you to identify the major occupations involved in road building. (Operating engineer, carpenter, ironworker, cement finisher, asphalt worker, engineer, contractor, and laborer.)
4. Have students help identify the major materials that are used for road building. (Concrete, asphalt, gravel, fill, and steel.)
5. Discuss and compare the three kinds of substructural systems in road construction:
   a. Regular asphalt road
      1) Fill dirt
      2) Gravel
      3) Asphalt covering
   b. Asphalt highway
      1) Fill dirt
      2) Gravel
      3) Concrete subsurface
      4) Asphalt covering
   c. Concrete highway
      1) Fill dirt
      2) Gravel
      3) Concrete surface
6. Bring out the differences between past, present, and future kinds of road constructions.
   a. Past construction
      1) Dirt roads
      2) Gravel roads
      3) Brick roads
      4) Log roads
      5) Cobblestone roads
   b. Present construction
      1) Concrete
      2) Asphalt
   c. Future construction
      1) Continuous concrete
      2) Asphalt

Discussion (5)

1. What are some of the main occupations involved in road building? (Operating engineers, carpenters, welders, laborers, cement finishers, painters, electricians, civil and mechanical engineers, draftsmen, surveyors, etc.)
2. Name three kinds of substructural systems of road construction. (Regular asphalt road, asphalt highway, concrete highway.)
3. What are the main materials for road building? (Fill dirt, gravel, asphalt, concrete.)

Laboratory Activity (25)

Today's activity is a continuation of the salvaging task.

1. Students will remove the window frame as a unit, exterior sheathing on the roofs and walls, interior wall materials, and the plumbing system.
2. Students are to follow the sequence outlined in Chart 70-74-3 in the Laboratory Manual.
3. Students are to salvage, clean, and store the reusable materials, and dispose of the rest. (Possible grouping: two students remove materials, two students clean materials, one student checks in the materials to the teacher, and stores the reusable materials.)
4. Check off the materials returned by each group before they are stored. See today's checklist, Fig. 134-1.
5. Caution students to take special care in removing the window unit so that it will remain intact for use again.

ACTIVITY 72
SALVAGE CHECKLIST
(Sheathing, paneling, plumbing)

	Class 1					Class 2					Class 3					Class 4					Class 5					Class 6					Total
Group:	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
SALVAGED PART																															
Roof sheathing																															
Side sheathing																															
Window unit																															
Front sheathing																															
Paneling																															
Drywall pieces																															
Insulation																															
1/2" elbows (2)																															
1/2" caps (2)																															
5" nipples (2)																															
12" galv. pipe																															
14" galv. pipe																															
1/2" drop-eared elbow (copper)																															
14" copper tubing																															

Fig. 134-1

Safety Precautions

1. Handle the propane torch and copper tubing with care.
2. If insulation was installed, care should be taken to prevent skin irritation.

Homework

Reading 73

ASSIGNMENT 135, UNIT 73

Building Skyscrapers (Salvaging)

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to building skyscrapers:
   a. Give reasons why you think the development and widespread use of skyscrapers is mostly American.
   b. Name the tallest building in your community and give some reasons why you think it was made so high.

Discussion

2. Given a series of questions:
   a. Name several major occupations involved in building skyscrapers.
   b. Name several structural materials that are used in building skyscrapers.
   c. State the main steps in building skyscrapers.
   d. State several uses of skyscrapers.

Laboratory Activity

3. Given the necessary equipment and a checklist, remove and salvage:
   a. Electrical wiring.
   b. Roof trusses.
   c. Wall frame.

Time Schedule

5	Overview*
10	Lecture*
5	Discussion*
25	Laboratory Activity

* Optional: Film on Building Skyscrapers replaces these segments.

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	screwdrivers
3	claw hammers
2	nail claws
2 pr.	slip-joint pliers

Overview (5)

1. Your text reading gave you information about who builds skyscrapers, how they are planned and designed, and construction practices for foundation framing, building floors and walls, installing utilities and finishing the interior.
2. I will tell you more about building skyscrapers.
3. You will be expected to answer questions concerning the major occupations of the workers and the structural materials used in building skyscrapers, the main steps involved in skyscraper construction, and several uses of skyscrapers.
4. During the laboratory activity, you will salvage the remaining electrical wiring, and the material from the roof trusses and wall frame.

Lecture (10)

1. Review with the students the story of

ACTIVITY 73

SALVAGE CHECKLIST

(Electric wiring, roof and wall framing members)

	Class 1					Class 2					Class 3					Class 4					Class 5					Class 6					Total
Group:	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
SALVAGED PART																															
Wiring, BX																															
Wiring, Romex																															
Wiring, B&W (3)																															
Conduit hanger																															
Box connector for conduit																															
Conduit																															
Box connector, BX (2)																															
Switch box																															
Outlet box																															
Lamp receptacle box																															
Bar hanger (lamp receptacle)																															
Ridge board																															
Upper chord																															
Lower chord																															
Soffit nailer																															
Brace (1 x 4)																															
Chord braces																															
Double plate																															
Top plate																															
Braces (2 x 4)																															
Studs																															
Header (window)																															
Sill (window)																															
Window framing (4)																															

Fig. 135-1

building skyscrapers as presented in the text.
2. Explain to the class what groups or persons are usually responsible for initiating, planning, and designing skyscrapers.
3. Mention some of the major occupations involved in building skyscrapers: ironworker, operating engineer, carpenter, cement finisher, stone mason, roofer, painter, electrician, sheet metal worker, and laborer.
4. Name the chief structural materials used in building skyscrapers: steel, concrete, and masonry.
5. Point out the basic steps in building skyscrapers: foundations, superstructure framework, enclosing frameworks, floors and walls, installation of utilities, interior finishing.
6. Point out some common or well-known uses of skyscrapers: office buildings, apartments, hotels, universities, and (at Cape Kennedy, Florida) assembling rockets for launching spaceships.
7. Identify skyscrapers in your community and the need for additional ones.

Discussion (5)

1. Name some occupations involved in building skyscrapers. (Ironworkers, operating engineers, most all tradesmen, mechanical engineers, architects, draftsmen, surveyors, contractors, etc.)
2. Name the structural materials used. (Steel, concrete, and masonry.)
3. Name the main steps in building a skyscraper. (Foundation, framework, etc.)
4. How are skyscrapers used? (As office buildings, apartment buildings, etc.)

Laboratory Activity (25)

Today the salvaging of the structure will continue.

1. Students are to remove the electrical wiring and disassemble the roof trusses and wall frame.
2. They are to follow the procedure outlined in the Laboratory Manual.
3. Students are to salvage, clean, and store the reusable materials, and dispose of the rest. (Possible grouping: two students remove materials, two students clean materials, one student checks in the materials to the teacher and stores the reusable materials.)
4. Check off the materials returned by each group before they are stored. See today's checklist, Fig. 135-1.

Safety Precautions

1. Do not lay down a board that has nails sticking up
2. Pull nails from building materials carefully.

Homework

Reading 74

ASSIGNMENT 136, UNIT 74

Constructing in the Future (Salvaging)

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to construction in the future:
   a. Give reasons why the development of construction technology has been slow in the United States.
   b. Describe what changes will have to be made if we are to meet the demands for structures of all kinds within the next 30 years or by the year 2000.

Discussion

2. Given a series of questions:
   a. State some obstacles facing construction in the future.
   b. Explain how the construction industry plans to overcome these obstacles.
   c. Name some new developments in design.
   d. Identify some of the construction materials of the future.
   e. State what type of labor will be needed.

Laboratory Activity

3. Given the necessary equipment and a checklist, complete the removal and salvaging operations of:
   a. Heating duct system.
   b. Floor tiles.
   c. Subfloor.
   d. Bridging.
   e. Header joists.
   f. Floor joists.

Time Schedule

5	Overview
10	Lecture
5	Discussion
25	Laboratory Activity

Equipment and Supplies for Lecture-Filmstrip

Equipment

1	filmstrip projector/screen

Supplies

1	Filmstrip 136

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

2	screwdrivers
2	claw hammers
2	nail claws

Overview (5)

1. The text reading described the challenge for constructing in the future and various techniques that might be used to meet this challenge.
2. I will show you a filmstrip about some construction trends of the future.
3. You will be asked to explain some of these new developments, as well as some of the obstacles facing construction in the future.
4. During the laboratory period, you will complete all salvaging operations.

Lecture-Filmstrip (10)

Show the filmstrip and read or paraphrase the lecture script.

Script for Filmstrip Lecture: Construction in the Future

Frame 1: Focus
Frame 2: Filmstrip 136
Frame 3: The World of Construction
Frame 4: Construction in the Future
Frame 5: Here is an imaginary city of the future. Note the skyscraper design, roadways, and heliports.
Frame 6: An office building of the future may look like this. Note the bubble-like cars parked in cells outside the building.
Frame 7: This is a cloverleaf interchange on an undersea highway of the future.
Frame 8: A mobile kiln (bridge constructor) of the future is supported by the bridge it builds.
Frame 9: An atomic reactor melts its

way through mountains to carve tomorrow's tunnel.

Frame 10: Giant overland highways and tubular underseas highways meet in this futuristic scene.

Frame 11: A cantilevered highway of tomorrow crosses Grand Canyon.

Frame 12: The family car is automatically washed, dried, and refinished in this motor port of the future.

Frame 13: Here is an office design of the future, today.

Frame 14: A truck-train is loading at a farm terminal in preparation for the trip to market over a high-speed freightway.

Frame 15: A space station is being constructed in outer space. This station will orbit the earth.

Frame 16: This imaginary space station is constructed on the moon.

Frame 17: University lecture hall and cafeteria of the future may look like this.

Frame 18: Here is an example of equipment that will be common in the future. This giant rock-crusher is used to supply rock and sand for concrete at a dam site on the Clearwater River near Orofino in Northern Idaho.

Frame 19: The end.

Discussion (5)

Today's discussion concerns construction in the future.

1. What are some major obstacles facing the construction industry in the future? (The development of construction technology has been slow. There has always been a resistance to change. The administrative costs connected with building a facility are high.)
2. How does the construction industry plan to overcome these obstacles? (New developments in design, techniques, materials, and use of manpower.)
3. Name some major new developments in design. (Introduction of modular system. Prefabricated units. New remodeling techniques.)
4. Name some of the construction materials of the future. (Molded wood in many new shapes. Wood laminates. Plastics. Fiberglass. Prestressed and precast concrete. Better adhesives. Better fasteners.)
5. Will the trend be for more skilled or nonskilled labor? (More skilled labor and less common labor.)

Laboratory Activity (25)

The students are to complete the salvaging operations today.

1. The duct system, the floor, and the subfloor are to be dismantled.
2. Students are to follow the procedure outlined in the Laboratory Manual.
3. All salvaging operations will be completed today.
4. Students are to salvage, clean, and store the reusable materials and dispose of the rest. (Possible grouping: two students remove materials, two students clean materials, and one student checks in the materials to the teacher and stores the reusable materials.)
5. Remind students of safety precautions and the removal of nails from all materials.
6. Check off the materials returned by each group before they are stored. See today's checklist, Fig. 136-1.

Safety Precautions

1. Do not lay boards down with nails sticking up.
2. Pull nails from building materials carefully.

Homework

Review of Reading 56 to 74. If optional Review Assignment 137 is used, have students bring their textbooks to class. If the review is not used, have students study for the test.

ACTIVITY 74
SALVAGE CHECKLIST
(Ductwork, floor, and subfloor)

	Class 1					Class 2					Class 3					Class 4					Class 5					Class 6					Total
Group:	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
SALVAGED PART																															
Bottom plate (sole)																															
Heat duct																															
Floor tile																															
Subfloor																															
Cross bridging																															
Solid bridging																															
Header joist																															
Floor joists																															
Chair glides																															
Sill plate																															
Girder plate																															
Skids (2)																															

Fig. 136-1

ASSIGNMENT 137, UNITS 56-74 (OPTIONAL)

Review 56–74

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

Given the summaries of Readings 56 through 74, ask and answer questions about roofing, enclosing exterior and interior walls, applying ceiling materials, laying flooring, painting and decorating, finishing the project, installing accessories, completing the site, transferring the project, and building dams, bridges, roads, and skyscrapers.

Time Schedule

45 Discussion or Laboratory Activity

Discussion or Laboratory Activity (45)

This review time can be used in various ways. Plan to do one of the following alternatives.

Alternatives

1. Students can play the "Big Builder" game to become more familiar with the concepts and processes of construction.
2. Pose the questions and situations at the end of each reading to stimulate thinking and discussion.
3. Have each "group" of students get together and list two or three words or concepts they would like to have explained or discussed. Discuss and clarify the concepts.
4. Ask a guest speaker, knowledgeable about interior construction works, to talk to the class. Schedule the speaker for the first class period and tape record his talk so it can be played to your other classes.
5. Schedule a field trip to a construction site where interior building construction is being done.

Homework

None

ASSIGNMENT 138

Test No. 7

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

Given IACP Construction Test No. 7, select the correct responses from a list of items related to concepts presented in Readings 56 through 74.

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

1. Seat the students to best advantage for administering a test.
2. Distribute pencils, erasers, and eraser shields.
3. Distribute answer sheets and have students fill out needed information.
4. Pass out test booklets. "Keep closed until I say to begin."
5. Read directions for filling in answers. Open test booklets and begin.
6. Allow 35 minutes for completion; then collect answer sheets, then test booklets.
7. Review the test with students to provide feedback.

Homework

Reading 75

Answers for Test No. 7

1. B 2. C 3. C 4. A 5. C 6. D 7. B 8. C 9. A

10. B 11. D 12. B 13. C 14. C 15. A 16. D 17. D 18. A

19. D 20. C 21. A 22. A 23. A 24. C 25. C 26. A 27. A

28. D 29. C 30. C 31. B 32. D 33. A 34. B 35. B

ASSIGNMENT 139, UNIT 75

Constructing Housing

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to constructing housing:
   a. Give reasons why there is a great demand for more housing units now than ever before in history.
   b. Identify whether more of your classmates live in apartments or single family homes and explain why the greater of the two is growing more rapidly.

Discussion

2. Given a series of questions, explain the functions of various rooms in a home.

Laboratory Activity

3. Given their homes as reference, determine whether the number of rooms and their sizes are adequate.
4. Given the construction laboratory, estimate its size by pacing off distances.

Time Schedule

5 Overview
10 Lecture
10 Discussion
20 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Group of 5)

1 yardstick

Overview (5)

1. You have read about past, present, and future trends in housing.
2. I will tell you more about housing.
3. You will be asked to explain the functions of the various rooms in a typical house.
4. You will complete a checklist showing whether the rooms of your home are adequate. Also, by pacing off distances, you will find the length and width of the laboratory floor.

Lecture (10)

1. You have read how man has progressed from such primitive dwellings as rock ledges and caves to the sophisticated homes and apartments in use today.
2. Early man built his home from such materials as animal skins, mud, stones, and brush.
3. Today man uses brick, wood, metal, glass, and plastic materials to build durable, beautiful, comfortable homes and apartments.
4. Some homes and apartments are built entirely on the site. Some are precut or prefabricated in a factory, then assembled on the site. Some houses are combinations of these construction practices.
5. Carpenters, masons, architects, plumbers, electricians, and surveyors are

among the many people who work together to complete homes.

6. Knowing about each profession and trade will help you to plan and build your dream house.
7. Future developments in construction techniques and materials will probably amaze all of us.

Discussion (10)

To help the students plan their dream homes, discuss with them the function and sizes of the following rooms.

1. Living room. (Main sitting and guest reception room of a home.)
2. Dining room. (For eating; quite often a part of the kitchen or living room.)
3. Kitchen. (For preparing meals, washing dishes. Often includes shelf storage space and refrigerator-freezer storage space.)
4. Master bedroom. (Usually the largest bedroom in the house.)
5. Bedrooms 2 and 3. (Usually smaller than the master bedroom. Sometimes large, "dormitory" style.)
6. Bathroom 1. (Full bath.)
7. Bathroom 2. (Usually half bath.)
8. Den or study. (Often used also as a spare bedroom for guests.)
9. Utility or laundry room. (If utilities are not housed in a basement, there will usually be a separate room to house them on the first floor.)
10. Family room or recreation room. (Usage depends on the family's wishes.)

Laboratory Activity (20)

1. Have each student complete Problem 1 (judging adequacy of present home).
2. Before they begin work on Problem 2 (estimating distances), explain the idea of stepping off distances:
   a. It is often necessary to estimate distances or sizes in construction work.
   b. One technique for estimating is called "stepping off" or "pacing."
   c. The purpose of stepping off your distances is to get the idea of "sizes of areas" for planning a house.
3. Each group will measure or lay out two parallel lines 3′ apart (one pace). Then each student will place his right toe on one line and left toe on the other. This will help him to understand a 3′ span or pace.
4. Have each group lay out lines 30′ apart. Each student should practice stepping off this distance in 10 paces.
5. Allow each student to pace off the width and length of the laboratory to estimate these distances, and record them in Fig. 75-2. After all estimates have been recorded, you may give students the correct dimensions, or let one group use the yardstick to measure the length and width.
6. If some students are too small or too short for a 3′ pace, help them to develop a 2′ or a 2½′ pace.

Homework

Reading 76. Also, have each student pace off the yard or lot of his home and record the length and width on paper. Students who do not have a yard to measure should help a friend measure his yard or an area of the school ground. This activity will give students some basis for visualizing (for example) a 100′ x 150′ lot as they plan their dream homes.

ASSIGNMENT 140, UNIT 76

Your Dream House

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to your dream house:
   a. Give some reasons why the houses you and your friends live in may or may not be the most ideal house.
   b. List what you can do now and within the next 15 to 20 years to help you obtain your ideal or dream house.

Discussion

2. Given that family size, activities, and occupational demands are factors to consider, state one particular family's physical requirements for a house.
3. Given pictures depicting nine common architectural styles, and a list of identifying characteristics, associate each description with the correct picture.

Laboratory Activity

4. Given forms, charts, and maps, decide the following:
   a. Physical requirements for a dream house.
   b. Economic status and cost of housing.
   c. Geographic conditions and materials available.
   d. Architectural style.

Time Schedule

5 Overview
15 Discussion-Filmstrip
25 Laboratory Activity

Equipment and Supplies for Discussion-Filmstrip

Equipment

1 filmstrip projector/screen

Supplies

1 Filmstrip 140 (Frames 1 through 19 only)

Overview (5)

1. You have read about various factors that affect house planning.
2. We will discuss how to estimate the personal and income requirements you will use in planning your dream house.
3. I will show you several architectural styles, and we will discuss the special features of each style.
4. During the laboratory period, you will complete several checklists to indicate the size of your future family, your expected income, climate conditions to be considered, and the architectural style you like best.

Discussion-Filmstrip (15)

1. Show Filmstrip 140, Frames 1-10. Use the comments and questions that follow as a basis for discussion.

Frame 1:	Focus
Frame 2:	Filmstrip 140
Frame 3:	The World of Construction
Frame 4:	Planning Your Dream House
Frames 5, 6, 7:	Family size, family activities, and occupations all affect personal requirements. What personal requirements will you consider in planning? (Separate rooms for sewing, carpentry, music, storage, recreation, etc.)
Frame 8:	This is how income is spent. What future income do you hope to earn? Is this sum in line with what you want to do for a career?
Frames 9, 10:	Geography will affect your building plans. What are some of the local geographic conditions that affect home building in this area? (Hills, rivers, weather, etc.)

2. Show Frames 11-19. Ask students to pick out key features of each architectural style. Develop the following points.

	Styles of Architecture	Identifying Characteristics
Frame 11:	Dutch Colonial	Slightly overhanging upper story; contrasting brick or stone lower story; sometimes has a gambrel roof.
Frame 12:	Southern Colonial	Large, two-story house, two-story columns used to support the front roof overhang; symmetrical, gabled roof.
Frame 13:	Georgian	Rectangular house; simple, bold cornice line; arched doorway with fanlight above; two or more stories; may have additions on one or both ends.
Frame 14:	Tudor (an Old English style)	Half-timbered exterior; separate chimney stacks which extend high above the roof line; arched, recessed doorway; small-paned windows; high-pitched gable roof; shallow dormers.
Frame 15:	Cape Cod (a New England style)	One-and-a-half stories; gabled roof with dormers; central front entrance; large central chimney; exterior walls of clapboard or bevel siding; double-hung windows with shutters; symmetrical floor plan; shake-shingle roofing.
Frame 16:	Spanish	Low-pitched, gable roof; usually stucco exterior wall; casement windows; balconies with decorative railings; sometimes built around a patio which may be enclosed on all four sides by the house.
Frame 17:	Oriental	One-story, large glass areas, rectangular sections.
Frame 18:	Ranch	One-story, spread out; flat or low-pitched roof; brick or wood frame; large-paned windows.
Frame 19:	Split-level	Floors are one-half story apart, saving steps; levels are usually divided into bedroom area, living and kitchen areas, and recreation and utility area. Style is similar to ranch or oriental.

3. What are the typical architectural designs found in the area where you would like to build your dream house?

Laboratory Activity (25)

1. There are four problems in the Laboratory Activity. Using checklists, students are to decide size, personal requirements, income requirements, and architectural style of the dream house for themselves and their future families.
2. Show students how to select income requirements from Chart 76-2. These figures can be related back to first semester when students studied training and educating for construction and selected an occupation or profession. For example, if a student planned to finish high school but not get any further education, he should select the house and lot costing $18,750. A student planning to complete high school plus 4 years of further education should select the house costing $25,000, etc. These points should be emphasized to keep the students within realistic limitations.

Homework

Reading 77

Note: It is strongly suggested that the teacher *plan* for, *design,* and *build* a "dream house" *along with the students* throughout the next few weeks. The model will help *facilitate demonstrations* and aid you in *pointing out precautions and problems* related to building a model house.

ASSIGNMENT 141, UNIT 77

Selecting and Purchasing a Lot

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to selecting and purchasing a lot:
   a. List what things you should consider when you are deciding what community you would like to live in.
   b. Give reasons why lawyers, realtors, and banks are important in the process of selecting and purchasing a piece of land.

Laboratory Activity

2. Given a checklist dealing with size, shape, topography, utilities, services, and prices of lots, select an appropriate lot for a dream house.
3. Given an "Offer to Purchase" form, complete it for a dream house lot.

Time Schedule

5	Overview
10	Lecture-Discussion
30	Laboratory Activity

Overview (5)

1. Your text reading explains why certain factors such as topography, zoning, titles, and deeds need to be considered when selecting and purchasing a lot.
2. During the lecture-discussion, you will be asked to explain the importance of topography, zoning, cost, utilities, and services in selecting a lot.
3. In the laboratory activity you will be asked to fill in a checklist which will guide you in the selection of a lot for your dream house.

Lecture-Discussion (10)

Today students will learn about several factors that must be considered when selecting and purchasing a lot. In presenting these factors, you may incorporate the following suggestions:

1. Identify some of the important factors:
   a. Topography of the land
   b. Zoning regulations
   c. Available utilities
   d. Location of schools, hospitals, churches, and shopping centers
   e. Fire and police protection
   f. Taxes
   g. Cost of the land
2. Several factors are listed in Problem 1 of the Laboratory Manual. Using this list, explain the following to the students and ask questions about the importance of each factor as it relates to local conditions.
   a. Lots can be located anywhere.
   b. Lots vary in size.
   c. Suburban lots can be located at a corner or in the middle of a block.
   d. Topography will vary with lots. (Only a few topographic features are mentioned on the checklist.)
   e. Most people want certain utilities and services available on the lot.
   f. Zoning regulations vary widely. Some regulations prohibit raising dogs, rabbits, or pigeons. Some forbid any services for which payment is accepted, such as repairing TV sets, giving dancing lessons, or "customizing" automobiles.
3. Mention the people who may be contacted when selecting and purchasing a lot: the realtor, the seller, the banker, the lawyer, the surveyor, and the registrar of deeds. Develop student understanding of the job that each of these people performs.

Laboratory Activity (30)

1. Using a checklist (Problem 1, Charts 77-1 and 77-2), each student will determine the topography, zoning, location, size, and cost of the lot for his dream house.
2. In Problem 2 each student will complete Chart 77-3, an "Offer to Purchase" (a blank legal document).
   a. Explain that you will read the form and help them complete this "Offer to Purchase" a lot.
   b. Each numbered instruction below is keyed to a number on the form.
      1) Write "town," "city," or "village."
      2) Write the name of the town, city, or village where the lot is located.
      3) Write the name of the county.
      4) Write the name of the state.

5) Write the name of the subdivision or property. Example: "Butterworth Estate."
6) Complete a description of the lot. Example 1: "Part of Military Lot 345." Example 2: "Parcel of land located along the north side of Highway 5, between Highway 8 and Highway 10."
7) Write the agreed price in words. Example: "One Thousand Dollars."
8) Write the agreed price as a numeral. Example: "$1,000."
9) Show the deposit amount as a numeral. Example: "$300."
10) Fill in the name of the lawyer, the realtor, or the owner. (Students may choose names from the telephone book, or make up names.)
11) Show the balance as a numeral. Example: "$700."
12) Write the closing date. This date should fall within 30 days from today.
13) Write the name of a lawyer, a realtor, or a bank.
14) Write the closing date; it is the same as Item 12.
15) This refers to the kind of deed. For this assignment, use the word "warranty."
16) Write the closing date; it is the same as Items 12 and 14.
17) This can be either the closing date or the date you will take possession of the property.
18) Write the name of the broker.
19) Write today's date.
20) Have a classmate or your teacher sign as witness.
21A) This is where the buyer signs. (If there are two buyers, one signs on blank 21B.)
22) Write the name of the realtor.
23) Write the percent to be paid the realtor as commission. Example: "6%."
24A) Write the date signed by the seller and buyer.
24B) The signature of the property owner (person selling lot) must be witnessed. Have a classmate sign here (someone other than the seller).
25A) This is where the property owner (person who is selling the property) signs.
25B) Have a classmate sign as the seller.

Homework

Reading 78

Planning the Living Space

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to planning the living space:
   a. Identify which basic activities require the most space in your present home.
   b. Make a sketch of the floor plan of your home and note the traffic pattern for a typical day.

Discussion

2. Given information from a lecture:
   a. Explain why basic and nonbasic activities are considered in planning room arrangement.
   b. Explain why the noisy and quiet areas of a house are separated.
   c. Explain what is meant by "traffic flow" within a house.

Laboratory Activity

3. Given a checklist of rooms and size, select those that are appropriate for their dream house.
4. Given two charts and a square-footage table, estimate the cost of the floor area of their dream house.

Time Schedule

5	Overview
10	Lecture
10	Discussion
20	Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1 filmstrip projector/screen

Supplies

1 Filmstrip 140 (Frames 20-22)

Equipment and Supplies for Laboratory Activity

Supplies (Each student)

2 shts. 8½" x 11" grid paper,
ruled ¼" x ¼"

Overview (5)

1. Your reading explained how the living space in a home relates to basic and nonbasic activities.
2. I will review the planning of basic and nonbasic activities, noisy and quiet areas, and traffic flow.
3. You will be asked to answer questions about planning basic and nonbasic areas, planning quiet and noisy areas, and traffic flow.
4. Using a checklist as a guide, you will select the rooms for your dream house and sketch them.
5. With the help of a table, you will figure the square footage of floor space and find the cost of building your dream home.

Lecture (10)

1. Many activities take place in a home. Some are basic; some are not.
   a. The basic activities are common to all people. Examples are sleeping, eating, washing, and relaxing. The major part of house planning concerns these activities.
   b. The nonbasic activities are those that fit the needs of an individual family: (a special room for sewing, a home workshop, a recreation room, etc.). Special planning is needed to provide rooms for these individual needs.
2. It is also important to plan the size of each room according to the activities that will take place within that room. For example, if a recreation room is to hold a pool table, several comfortable chairs, and space for dancing, it should be a large room.
3. In planning it is also a good idea to separate the noisy and quiet areas of the house. A bedroom or study should not be too near the kitchen, workshop area, or garage.

   Note: Filmstrip 140, Frames 20, 21, and 22 may be used to show average room sizes and proportion.

4. Traffic flow must be considered so that it will be convenient to go from each part of the house to the various other areas. For example, it should be possible

to walk from the kitchen to the front door without going through several rooms.

5. You will need to develop a cost budget to include the lot, professional services, and the cost of building your dream house.

Discussion (10)

1. What are some of the basic and nonbasic activities that take place in a home? (Eating, washing, sleeping, relaxing, practicing a musical instrument, sewing, playing pool.)
2. Why will you want to separate the noisy and quiet areas of your house? (So that some family members can work without disturbing others who are asleep or resting.)
3. How can the traffic flow in a house be controlled? (By planning in advance, so that rooms and doorways are arranged for convenient movement through the house.)
4. What does the architect consider when he is deciding the sizes of rooms? (The kinds of activities that will take place there, and the furniture or equipment that will be needed.)
5. What kinds of costs are involved that you will need to know in developing a preliminary budget? (Building costs, lot costs, professional advice.)

Laboratory Activity (20)

Each student will select the rooms and room sizes for his own dream house. We will then calculate an estimated cost for building a house, based on these rooms. If necessary, he will revise his selection of rooms or sizes. Finally he will transfer these room-size dimensions to grid paper.

1. Review the directions for Problems 1 and 2.
2. After the students have selected their rooms and room sizes, it is important that they be guided to approximate whether their means will be sufficient for their wants. If not, they will have to make some adjustments in their plans. Give help as needed with Problem 2.
3. If, on completing Problem 2, students find that they have extra money available, they could plan to spend it for features such as a swimming pool, patio, workshop, garage, carport, etc.
4. When you distribute the grid paper for use in Problem 3, briefly review the concept of scaling, if necessary. Students are to use the scale ¼″ = 1′.
5. Remind students that they *will not* cut out the room outlines today.

   Note: At this point, a student who has not given evidence of being able to originate a dream house plan for himself may be given the option of planning a house or apartment for sale. For this purpose he may use examples from his Laboratory Manual.

If any students continue to have great difficulty in developing a floor plan, after several days of effort, you may want to provide them with a floor plan that is already completed. Figure 142-1, Scaled Floor Plan, is located at the end of the Teacher's Guide so that you can have it duplicated for that purpose.

6. Have students store their room sketches in their Laboratory Manuals, or you may collect them and store them in file folders.

Homework

None

ASSIGNMENTS 143, 144, UNITS 78B,C

Planning the Living Space

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given the rooms in a house:
   a. Explain four basic activity areas.
   b. Explain four nonbasic activity areas.

Laboratory Activity

2. Given rooms and their sizes from Activity 78A, group them into basic and nonbasic areas.
3. Given the space relationships of basic and nonbasic areas, develop a workable floor plan for a dream house.

Time Schedule, 143

5	Overview
15	Lecture-Demonstration
5	Discussion
20	Laboratory Activity

Time Schedule, 144

5	Overview
40	Laboratory Activity

Equipment and Supplies for Lecture-Demonstration

Equipment

1	overhead projector/screen
1	filmstrip projector

Supplies

Transparencies 143-1 and 143-2
Filmstrip 140, Frames 20, 21, and 22
Cutout scale model rooms*

* Before beginning his presentation, the teacher should trace the floor plan in Fig. 143-1 and cut along the wall lines to make pieces for use with Transparency 143-1.

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1 pr. scissors

Supplies (Each student)

1 sht. 12″ x 18″ grid paper, ruled ¼″ x ¼″
2 shts. room sketches, from Activity 78A

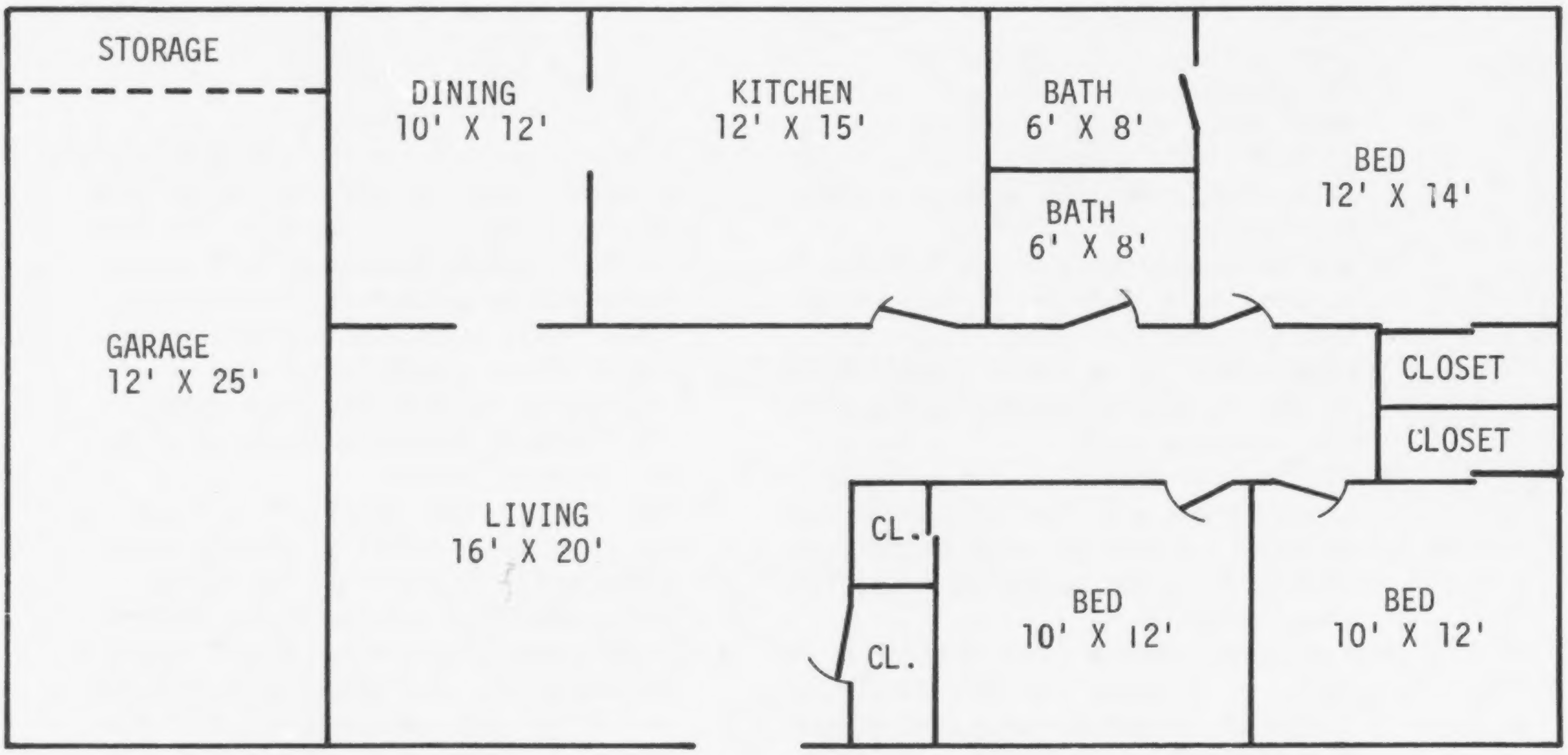


Fig. 143-1. These Rooms Should Be Traced and Cut Out for Use with Transparency 143-2, a ⅛″ Grid

Overview (5)

1. Yesterday you planned the rooms for your dream house and chose their approximate sizes.
2. Today I will demonstrate, with a set of cutout rooms, how to arrange several rooms into a floor plan.
3. During Laboratory Activity 78B and C, you will arrange your rooms into suitable groups. Then you will prepare a rough floor plan which will later be developed into working drawings for your dream house.

Lecture-Demonstration (15)

The purposes of this presentation are to identify room functions, room relationships, and techniques for developing a usable floor plan for a home.

Part I—Lecture

1. A *room* usually has *several functions.* These functions may all represent the *same* general kind of activity; for example, recreation. Often two or three *different* kinds of activity are carried out in the same room; for example, cooking and eating.
2. The *living room* is designed for many activities. Its uses depend on the needs of the family. It may be used as an entertainment center, a recreation center, a library, a music room, a television center, a reception room, a social room, a study, and a dining area.
3. The *family room's* main purpose is to serve as a central area for the individual needs of family members. Activities might include sewing, hobbies, and recreation.
4. The *recreation room's* main purpose is to serve as a place for indoor recreation activities. It is similar to the family room in that it supplies a central facility for the family's needs; in this case, the recreation need.
5. The main purpose of a *den* or *study* is to supply an area for quiet relaxation or work. Activities may be reading, writing, drawing, a hobby, or professional work.
6. The *dining room's* main purpose is to serve as a place for the family to gather for breakfast, lunch, and dinner. Sometimes the dining room is used only for special occasions or to entertain guests for meals. In many homes the dining room is used also as a sewing room, study, or hobby area.
7. The *kitchen's* primary purpose is to serve as a place to prepare food. It may also serve as a casual dining room. It is frequently used for hobbies that require a supply of water such as art and craft projects or indoor gardening.
8. The *bedroom's* first purpose is to serve as a place to sleep and dress. It also provides privacy. It is usually the room in which a sick or injured family member remains while recuperating. The bedroom of a young child may be his or her playroom. Throughout the years in school as a child, a teenager, and a young man or woman, one may prepare homework assignments, play a musical instrument, and pursue a succession of hobbies in this room. A bedroom or an area which can be conveniently converted to a sickroom should be fairly near the kitchen.
9. One primary purpose of a *bathroom* is to serve as a place for bathing. This may include the bath care of children until they are old enough to tend their own needs. A bathroom may also be used for dressing, exercising, sunning, hand laundering, first aid for minor injuries, and personal grooming. One bathing area should be near one entry (not the front entry). Sandbox sand, engine grease, potting soil, patching cement, and wet dogs are all hard on carpeting and other floor coverings.
10. The *utility room's* main purpose is to house facilities for washing, drying, and ironing clothes; for sewing; and for storing cleaning equipment. It may also house heating and air conditioning equipment, water tanks, and electrical equipment. There should be an area where very young children can play safely, so their mother can watch them while she is ironing or sewing.
11. One main purpose of a *porch* is to serve as a covered, outdoor recreation area. Coats and boots which are icy, muddy, or rain-soaked may be removed on a covered porch and temporarily stored there. Packages may be delivered onto a porch, so that delivery men need not enter the house. A porch may be enclosed with glass or screening, or it may be open.

12. The *entry's* main purpose is to provide an access area into and out of a building.

Part II—Demonstration

1. Show Transparency 143-1, Basic Floor Plan of a house. Using overlays, show area relationships; that is, how purpose links together the four basic activity areas. The sequence is designed for presentation as follows:
   a. Basic floor plan of a home.
   b. Relationship of sleeping area to the washing area.
   c. Relationship of living area to the washing area.
   d. Relationship of eating area to the washing area.
   e. Relationship of all areas to each other.

   Explain that these relationships are not the only factors to consider in arranging a floor plan. There are other considerations such as the flow of traffic, centralizing of utilities, etc.
2. Using Transparency 143-2 (Grid) and cutout scale models of individual rooms, demonstrate how to develop a floor plan. Show students how to arrange various rooms to form a complete floor plan.* If time permits, you may show them how to arrange these cutout models in a variety of ways. Emphasize to students that space not yet considered will be required for the entry, the hallways, and the closets. To arrive at a floor plan that is rectangular and has straight walls, the dimensions of these additional features will need to be chosen later.

* As an alternate way of demonstrating floor plan development, you could glue the room cutouts to abrasive paper and arrange groupings on a flannel board.

Discussion (5)

1. What are some of the main kinds of home activities and rooms in which they most often are carried out?
   a. Relaxing, reading, entertaining—living room, family room, recreation room.
   b. Eating, preparing food—kitchen and dining room.
   c. Washing, toileting, minor first aid—bathroom.
   d. Sleeping, dressing—bedroom.
   e. Recreation, sewing, practicing music—family room, recreation room.
2. Why should the bedroom and bathroom be located near each other? (For convenience in washing, bathing, dressing, etc.)
3. Why should the kitchen and dining room be near each other. (For convenience in carrying hot foods and dishes, getting additional servings, clearing the table.)

Laboratory Activity (20)

1. Students are to arrange the cutout rooms for the dream house into a usable floor plan.
2. They will then trace around these rooms, to form a rough sketch of a completed floor plan.
3. Students may need to arrange the rooms several different ways before they obtain a suitable floor plan.
4. Have students store their sketches according to your directions.

Homework

For Assignment 144, none. For Assignment 145, Reading 79.

Note: For overview of Assignment 144, review the above lecture and discussion. Laboratory Activity 78C will be a continuation of Activity 78B.

ASSIGNMENT 145, UNIT 79A

Preparing Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to preparing working drawings:
    a. Explain what would happen if a builder or contractor tried to build a house without the necessary drawings.
    b. Give reasons why the floor plan is considered to be the most important working drawing.

Discussion

2. Given a text reading and lecture about working drawings, name the kinds of working drawings needed for house construction.
3. Given the kinds of working drawings needed for house construction, explain the importance of the floor plan.

Laboratory Activity

4. Given a rough floor plan including the basic rooms arranged in proper relationship:
    a. Refine the floor plan to include closets and halls.
    b. Establish final exterior wall location and shape.
5. Given a basic unit cost of $15.00 per square foot, figure a cost estimate for a dream house.

Time Schedule

5 Overview
15 Lecture
5 Discussion
20 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1 12″ rule

Supplies (Each student)

1 sht. 12″ x 18″ grid paper, ruled ¼″ x ¼″
1 floor plan sketch from Activity 78C
1 4H pencil
1 2H pencil

Overview (5)

1. The reading explained the kinds of drawings needed to make up a complete set of working drawings.
2. I will tell you what is included in a set of working drawings and explain a site plan, floor plan, elevation drawings, structural sections, detail drawings, foundation or basement plan, roof plan, electrical plan, heating plan, etc.
3. You will be asked questions about the kinds of drawings you will prepare, as you plan your dream house.
4. In the laboratory you will use your floor plan sketch to begin preparing working drawings, and figure the cost of your dream house.

Lecture (15)

This lecture should introduce the material covered in Activities 79A-G, preparing working drawings for a dream house.

1. As you talk, refer to the figures in the text.
2. Discuss all kinds of working drawings: site plan, floor plan, elevation drawings, structural sections, detail drawings, foundation or basement plan, roof plan, electrical plan, heating plan, air conditioning plan, ventilating plan, and plumbing plan.
3. Emphasize those drawings which the students will be preparing, and which they will use during the construction of their dream houses: plot plan, floor plan, foundation plan, electrical plan, and elevation drawings.

Discussion (5)

The discussion should focus on working drawings and the importance of a floor plan.

1. What kinds of working drawings are needed to build a house? (Site plan, floor plan, foundation plan, structural sections, details, elevation drawings, roof plan, electrical plan, heating, cooling, and ventilating plan, and plumbing plan.)
2. Why is a floor plan important? (It shows the location and size of the basic struc-

ture. It is used to develop all other working drawings.)

3. Now you have your rooms arranged and have a rough sketch of the floor plan to work from. What should you keep in mind about hallways and closets? (Allow enough space so they can be put in or between rooms.)

Laboratory Activity (20)

The laboratory activity for today will consist of two problems.

1. In Problem 1, students will refine on grid paper the floor plans for their dream houses. They are to draw exterior and interior walls, and add stairways, closets and hallways.
2. Go over the instructions if necessary before distributing supplies.
3. All walls are to be drawn ¼" wide to facilitate use of the urethane building materials.
4. Help students who may have problems.
5. Work not completed can be done outside of class.
6. You may collect and keep the floor plans, or have the students paper clip them in their Laboratory Manual. (A large manila envelope can be attached on the inside of the back cover of a Laboratory Manual, for storing drawings.)

Note: Compare local cost per square foot of building a house with that of the average, $15 per square foot, and make the necessary adjustments if desired.

Homework

None

ASSIGNMENT 146, UNIT 79B

Preparing Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a refined dream house floor plan:
   a. Locate and lay out doors and windows.
   b. Prepare a tracing that shows overall dimensions, room names, and sizes.

Time Schedule

5 Overview
5 Demonstration
35 Laboratory Activity

Equipment and Supplies for Demonstration

Supplies

1 sht. 12" x 18" tracing paper
1 roll masking tape

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1 12" rule

Supplies (Each student)

floor plan from Activity 79A
1 sht. 12" x 18" tracing paper
1 4H pencil
1 2H pencil
6" masking tape

Overview (5)

1. Today I will demonstrate how to draw in and code the windows and doors, and the procedure for making a tracing. You will use your original plan later in constructing your dream house. The tracing will be used to develop the electrical plans and provide you with a record.
2. There may be size adjustments you need to make in your dream house plan.
3. Then you will locate, draw in, and code the windows and doors. You will also prepare a tracing that shows the overall dimensions, room names, and sizes.

Demonstration (5)

Have students refer to figures in their Laboratory Manuals as you demonstrate.

1. Draw a workable floor plan on the chalkboard. Refer to Fig. 79B-1 in the Laboratory Manual and explain that windows may be *centered* on the exterior walls of most rooms. Windows should be appropriate: low, large picture windows in living and dining rooms; higher windows in bedrooms because of furniture underneath.
2. Demonstrate placement of doors: one main entry, one rear entry, and doors between most rooms.
3. Explain standard windows, door sizes, and symbols as found in Figs. 79B-2, 79B-3, and 79B-4 in the Laboratory Manual. Show students how some of these would be drawn.
4. Show students how to code their windows and doors as shown in Fig. 79B-5.
5. Demonstrate how to make a tracing of a floor plan, what dimensions are needed, and how to identify the rooms and their sizes as shown in Figs. 79B-6 and 79B-7.

Laboratory Activity (35)

1. Assist students in locating and laying out doors and windows (with proper symbols and code) on their dream house floor plans.
2. Help each student to prepare a tracing and enter overall dimensions, room names, and sizes.
3. Have students store their drawings according to your directions.

Homework

None

ASSIGNMENT 147, UNIT 79C

Preparing Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a dream house floor plan, trace wall lines and prepare a foundation drawing.
2. Given a floor plan tracing, show the locations of electrical light fixtures, switches, and convenience outlets.

Time Schedule

5	Overview
10	Demonstration
30	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1	12″ rule

Supplies (Each student)

1 ea.	floor plan and tracing, from Activities 79A and 79B
1	4H pencil
1 sht.	12″ x 18″ tracing paper
1	2H pencil
6″	masking tape

Overview (5)

1. Today you will continue preparing the working drawing for your dream house.
2. I will demonstrate how to draw a foundation plan.
3. I will also show you how to select electrical symbols and enter them on a floor plan tracing, to show electrical installations.
4. During the laboratory activity, you will prepare a foundation plan and an electrical plan.

Demonstration (10)

1. Refer to Figs. 79CD-1 and 79CD-2, Unit 79C in the Laboratory Manual. Using the

chalkboard, develop a plan for a spread foundation or a slab foundation.

2. Emphasize the following points:
   a. A foundation plan shows the substructure (footings and foundation wall) that will be needed to support the superstructure.
   b. A floor plan would be useless to the contractor without a plan showing the kind of foundation it will rest upon and some idea of where the house and foundation will sit on the lot.
   c. There are various kinds of foundations: spread, slab (floating), and piled.
3. Sketch on the chalkboard a kitchen and living room or bedroom, and demonstrate how electrical symbols for outlets, switches, and lights are shown on the floor plan.

Laboratory Activity (30)

1. Today the students will prepare a foundation plan from their floor plan (Problem 1) and enter electrical symbols on a floor plan tracing (Problem 2).
2. See that each student has a clean piece of tracing paper for use in Problem 1.
3. For Problem 2, students will use a tracing they prepared in Activity 79B.
4. Assist students having problems.
5. Each student should complete the electrical symbols for at least three rooms of his dream house if possible.
6. Have students store their drawings according to your directions.

Homework

None

ASSIGNMENT 148, UNIT 79D

Preparing Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given a series of questions:
   a. Name the four views found in elevation drawings.
   b. Explain how to compute the slope of a roof if the run and rise are known.
   c. Explain five of the lines found in elevation drawings.

Time Schedule

5	Overview
30	Demonstration
10	Discussion

Equipment and Supplies for Demonstration

Equipment

1	overhead projector/screen
1	filmstrip projector

Supplies

Transparencies 148-1, 148-2, 148-3
Filmstrip 140, frames 23 through 34

Overview (5)

1. Today I will demonstrate how to draw a front elevation and a right side elevation from a floor plan.
2. I will show you how to compute the slope of the roof for your dream house.
3. You will be asked to explain:
   a. What views are included in an elevation drawing.
   b. How roof slope is computed.
   c. What lines are commonly used in drawing elevations.
4. I will show you a filmstrip illustrating many styles of roofs, and you will select one for your dream house.

Lecture-Demonstration (30)

Explain that this is the procedure students will use to draw their elevation plans.

1. Show Transparency 148-1, Projecting the Front Elevation, with overlays A-D, and explain the relationship of the elevation views to the floor plan.
2. Show Transparency 148-2, Projecting Side Elevation, with overlays A-G.
   a. A horizontal line is drawn to represent the floor line. (Overlay A)
   b. By laying a rule along the outside house wall at the left, a vertical line can be extended downward. This will locate the left corner of the house.
   c. In the same way, a rule is laid along the outside house wall at the right, and a line is extended downward. This will be the right corner of the house.
3. Show Transparency 148-1 again, with overlay A. The next step is to measure up 8 units from the floor line. This represents 8′ scaled. Draw a horizontal line from one end of the house to the other. This is the top of the front wall, called the *top line*.
4. The roof slope and shape on many gable homes can only be determined by drawing a side elevation.
5. Project Transparency 148-2, Floor Plan Side Elevation, the right side view. Explain its relationship to the floor plan.
6. Show Transparency 148-2 with overlay A.
   a. A horizontal line is drawn to represent the floor level.
   b. Vertical lines are extended down to mark off the left and right edges.
7. Show Transparency 148-2 with overlay A. The draftsman measures up 8 units from floor level and draws a horizontal line to form the top of the side wall, or top line.
8. Show Transparency 148-2 with overlay B. Explain how to compute the roof slope for the house.
   a. Draw a horizontal line 12 units in length (the run).
   b. At the right end of this line extend a vertical line 3 units or 4 units high (the rise).
   c. The diagonal line from the left end of horizontal line to the 3-unit or 4-unit mark on the vertical line will form the slope of the roof. For example: $\frac{3}{12} = \frac{1}{4}$ slope, $\frac{4}{12} = \frac{1}{3}$ slope.
9. Each student's slope will differ slightly. A 1 to 4 slope or a 1 to 3 slope would be considered a medium sloped roof. A roof with a run of 12 and a rise of 6 ($\frac{1}{2}$ slope) would be a steep sloped roof. One with a run of 12 and a rise of 2 would be a $\frac{1}{6}$ slope or a low sloped roof.
10. Show Transparency 148-2 with overlay B. The top wall line is divided in two and a center line is drawn through this point.
11. Use Transparency 148-2 with overlay C.
    a. Measure over from the left end of the top line to the right 12 units. This is the *run*.
    b. At this point, measure up 4 units. This is the *rise*.
    c. Draw a diagonal line from the beginning of the run to the top of the rise. This line forms the left roof line.
    d. Begin at the right and at the top line and construct the right roof line. It should cross the left roof line at the center line.
    e. Allow roof lines to overhang 2 units.
12. Show Transparency 148-3, Figuring Roof Slope.
    a. Both houses have a slope of 4 to 12 or 1 to 3, but the lengths of the houses are different.
    b. The peak of the 30′ house is higher than where the rise is located.
    c. The peak of the 20′ house is lower than where the rise is located.
13. Return to Transparency 148-1 with overlay B.
    a. Transfer the height of this center line, measured from top line to ridge. (Distance R)
    b. Next draw a horizontal ridge line and allow it to overhang 2 units at both ends. (Distance X)
14. Use Transparency 148-1 with overlay C.
    a. Extend lines downward, marking the widths of all windows and doors.
    b. The top measurements of all windows and doors will be 6′8″ above the floor level.
    c. The heights of windows will vary according to personal tastes and the need for privacy.
15. Use Transparency 148-1 with overlay C.
    a. Draw the horizontal lines to complete all windows and doors for this view.

16. Return to Transparency 148-2 with overlay C.
    a. Extend vertical lines downward, marking the widths of all windows and doors.
    b. Draw the horizontal lines to complete the windows and doors.
17. This completes the preliminary drawing for both the front and right side elevations.
18. Using Filmstrip 140-1, Frames 23, 24, 25, and 26, explain that there may be more than one style for a front elevation. Using Frames 27 through 34, explain the various roof styles and types.

Discussion (10)

Use the following questions to encourage discussion.

1. What four views are usually shown in elevation drawings? (Front, rear, right side, and left side.)
2. How is the slope of a roof found? (It is the rise over the run, stated as a fraction. For example, with a *rise* of 3′ over a *run* of 12′, the slope is $\frac{3}{12}$ or $\frac{1}{4}$. It is usually called a 1 to 4 slope.)
3. Explain what these lines show on elevation drawings:
    a. Ridge line.
    b. Eave line.
    c. Finish grade line.
    d. Roof line.
    e. Overhang.

Homework

None

ASSIGNMENT 149, UNIT 79E

Preparing Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a floor plan and a guide to drawing elevations:
    a. Develop a right side elevation for their dream home.
    b. Develop a front elevation for their dream house.

Time Schedule

5	Overview
40	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1	architect's scale

Supplies (Each student)

2 shts.*	12″ x 18″ grid paper, ruled ¼″ x ¼″
1	2H pencil
1	8″ piece masking tape

* Given two sheets of 12″ x 18″ grid paper, students will be able to draw a front and a rear elevation on one sheet; a right and a left side elevation on the other. Some teachers prefer all elevations on one larger sheet. Others want each elevation on a separate sheet. Precut the paper to suit your preference.

Overview (5)

1. Today you will develop elevations for your dream house using the procedures I showed you yesterday.

Laboratory Activity (40)

1. Explain how to tape down a floor plan and then tape grid paper either below it or beside it so key lines can be extended downward or to the side.
2. Help students as necessary. In particular assist them in determining a roof slope.

3. The term "slope" as used in this activity has the same meaning applied in simple mathematics. It is the ratio of rise over run. The term "pitch" as used in architecture and construction has a different mathematical meaning based on the whole span of a gable-end roof.
4. Have students store their drawings according to your directions.

Homework

None

ASSIGNMENT 150, UNIT 79F

Preparing Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a refined floor plan and a guide to drawing elevations, draw the left side elevation for the dream house.
2. Given a refined floor plan and a guide to drawing elevations, draw the rear elevation for the dream house.
3. Given a completed set of elevation drawings, add the style of windows and doors and draw partial views to show exterior treatment of the dream house using building materials symbols such as bricks, siding, and glass.

Time Schedule

5 Overview
5 Demonstration
35 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Problems 1, 2, and 3

Equipment (Each student)

1	architect's scale

Supplies (Each student)

right side and front elevation drawings, from Activity 79E

1	2H pencil
1	4" piece masking tape

Overview (5)

1. Yesterday you drew the front and right side elevations of your dream house.
2. Today you will draw the remaining two elevations: the left side and rear views.
3. If time permits, you will be asked also to show on these drawings the exterior building materials such as brick or shingles and the styles of windows and doors you want.

Demonstration (5)

1. Refer to Figs. 49F-1 and 49F-2 in the Laboratory Manual. Show students how to choose window and door styles and how to draw them on their dream house elevations.
2. Refer to Fig. 49F-3 in the Laboratory Manual. Explain how various building-material symbols are used on elevation drawings to show what materials are wanted.

Laboratory Activity (35)

1. Hand out equipment and supplies.
2. Students should first complete elevation drawings (Problems 1 and 2).
3. They may then enter information about windows, doors, and exterior treatment, as time permits.
4. Explain that the assignment may be completed at home.
5. Walk around the room, giving aid as needed.
6. Have students store their drawings according to your instructions.

Homework

None

ASSIGNMENT 151, UNIT 79G

Preparing Working Drawings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the scale ⅛" = 1', lot size, and floor plan, draw a plot plan for the dream house.

Time Schedule

5 Overview
10 Demonstration
30 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1 architect's scale

Equipment (Class)

several pr. scissors

Supplies (Each student)

1 2H pencil
1 dream house floor plan
1 sht. *grid paper, ruled ⅛" x ⅛" (12" x 18" paper, ¼" grid can be taped together and ruled to ⅛")

* Have some grid paper precut into strips 25" wide and some precut 12½" wide. If you prefer, students may use plain kraft paper or newsprint for today's activity.

Overview (5)

1. Today I will demonstrate how to draw a plot plan and explain its use. I will explain how to use ⅛" grid paper and how to scale down dimensions so that ⅛" represents one foot.
2. During the laboratory activity, you will finish any parts of Activity 79F that are still incomplete.
3. You will then draw a plot plan for your dream house.

Demonstration (10)

1. Explain and show on the chalkboard how to lay out a plot plan on a building lot.
2. Mention some of the factors that affect house placement on a lot: building codes, distance from neighbor's property line, existing trees and topographical features, soil, and utility services into property.
3. Demonstrate how to change a dimension from ¼" scale to ⅛" scale by simple division. (For example, if a length were 10" on the ¼" scale, it will be 5" on the ⅛" scale.)
4. You may want to give some information concerning concrete areas: a single drive way is 8' wide; a double driveway is 16' wide; house sidewalks are 3' wide, etc.

Laboratory Activity (30)

1. Students should complete the elevation treatment of their dream houses before they begin a plot plan.
2. A chart in the Laboratory Manual shows the scaled dimensions for all the lots "purchased" in Activity 77. Each student is to identify his lot size and cut a piece of paper of the correct size. It is suggested that you have grid paper precut in two widths: 25" and 12½".
3. This Activity can be carried out on plain paper with more emphasis on the creative or imaginative aspects.
4. Have students store their drawing according to your directions.

Homework

Reading 80

ASSIGNMENT 152, UNIT 80

Writing Specifications

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to writing specifications:
   a. Explain how specifications protect the interests of the architect, the builder, and the owner.
   b. Identify what problems might come up if the specifications are not complete.

Discussion

2. Given a lecture on the use of catalogs, explain what kind of information is needed to complete specification schedules for doors, windows, and room materials.

Laboratory Activity

3. Given a room material specification chart and catalogs, select suitable materials for walls, ceilings, and floors of a dream house.
4. Given elevations and a floor plan, window or door schedules, and catalogs, specify suitable sizes and styles of doors and windows for a dream house.

Time Schedule

5	Overview
10	Lecture
5	Discussion
25	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (class)

2	builders' supply catalogs
2	Sears catalogs
2	Montgomery Ward catalogs

Supplies (Each student)

1 set elevations and floor plan of a dream house

Overview (5)

1. Your reading explained kinds of specifications and how they are used.
2. I will tell you more about how and why specifications are written.
3. You will be asked to explain what kind of information is needed to complete the specification schedules for doors, windows, and room materials.
4. During the laboratory activity you will decide what type of materials you want for the walls, floors, and ceilings of your dream house and compile a window or door schedule for your dream house.

Lecture (10)

Today students will begin to compile the specifications for their dream houses. The teacher's presentation will focus on how to use catalogs as a guide in specifying materials. The following points should be covered.

1. Specifications schedules are written for all windows, doors, paint, plumbing fixtures, electrical fixtures, and built-in appliances. (To save time, students will be scheduling only windows and doors.)
2. Data specified for each material and item may include: size, quantity, style, brand, catalog number, and cost.
3. Specifications are recorded on a chart or list for each kind of item. For example, data for all the windows will be specified on one list. Each list is called a "schedule."
4. Architects and contractors refer to catalogs when they are writing specifications. (Show students how to use the index and table of contents in the available catalogs.)
5. There are many factors to be considered when writing specifications:
   a. Economy—Is the cost reasonable?
   b. Quality—From what grade of material is it made? How carefully was it made?
   c. Style—Will the appearance suit my house?
   d. Service requirements—Can it be repaired quickly?
   e. Warranty—For how long is the item guaranteed?
6. You will prepare only the specification schedules for windows and doors. A complete set of specifications would include schedules for all materials and also the specifications for work, written out in sentences.
7. An architect marks a floor plan so that each kind of window and door has its own

code symbol. The doors are lettered (A, B, C, etc.). If two doors are alike, they are assigned the same letter. The different kinds of windows are numbered (1, 2, 3, etc.). Today you will letter the doors on your floor plan and number the windows.

Discussion (5)

1. What kinds of information should be specified on a door or window schedule? (Size, type, number needed, material, catalog number, description, and cost.)
2. Why must you write specifications very precisely and carefully? (To obtain exactly what you want.)
3. What are some of the factors to consider when writing specifications? (Economy, quality, style, ease of servicing, length of guarantee.)

Laboratory Activity (25)

Today students will select room materials and compile the specifications for windows or doors in their dream house.

1. Have enough catalogs on hand for today's activity.
2. Explain how to fill out the "Room Material Schedule" (Chart 80-1). For each of three rooms, the student should choose and check one floor material, one wall material and one ceiling material. They may use any suitable catalog.
3. Help students as problems arise.
4. The students should be able to complete the activity during the allotted time. If not, they should complete it at home. (Some students may wish to complete all three charts.)
5. Students should remove the schedules from the Laboratory Manuals and store them with their drawings.

Homework

If Review Assignment 153 (Optional) is used, have students bring their textbooks to class. If the review is not used, have students study for the test.

ASSIGNMENT 153 (OPTIONAL)

Review 75–80

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given the summaries of Readings 75-80, ask and answer questions about constructing housing, building your dream house, selecting and purchasing a lot, planning living space, developing a rough floor plan, making a set of working drawings, and writing specifications.

Time Schedule

45 Discussion or Laboratory Activity

Discussion or Laboratory Activity (45)

This review time can be used in various ways. Plan to do one of the following alternatives.

Alternatives

1. Students can play the "Big Builder" game to become more familiar with the concepts and processes of construction.
2. Pose the questions and situations at the end of each reading to stimulate thinking and discussion.
3. Have each "group" of students get together and list two or three words or concepts they would like to have explained or discussed. Discuss and clarify the concepts.
4. Ask a guest speaker, knowledgeable about house construction to talk to the class. Schedule the speaker for the first class period and tape record his talk so it can be played to your other classes.
5. Schedule a field trip to a construction site where a house is being built.

Homework

None

ASSIGNMENT 154

Test No. 8

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given IACP Construction Test No. 8, select the correct responses from a list of items related to concepts presented in Readings 75-80.

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

1. Seat the students to best advantage for administering a test.
2. Distribute pencils, erasers, and eraser shields.
3. Distribute answer sheets and have students fill out needed information.
4. Pass out test booklets. "Keep closed until I say begin."
5. Read directions for filling in answers. Open test booklets and begin.
6. Allow 35 minutes for completion; then collect answer sheets, then test booklets.
7. Review the test with students to provide feedback.

Homework

Reading 81

Answers for Test No. 8

1. C 2. B 3. D 4. A 5. D 6. C 7. A 8. A 9. B
10. D 11. D 12. C 13. B 14. D 15. A 16. C 17. D 18. B
19. A 20. C 21. A 22. D 23. C 24. B 25. B 26. A 27. C
28. B 29. D 30. D 31. A 32. C 33. B 34. D 35. A

ASSIGNMENT 155, UNIT 81

Financing and Contracting

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to financing and contracting:
   a. Explain how mortgage interest rates affect the size home you can buy.
   b. Describe the kind of experience and training you would need to act as an owner-builder without any contract.

Discussion

2. Given three types of contracts, identify the type they would prefer in contracting for their dream house.
3. Given the various types of lending institutions, explain what information is needed when applying for a loan and for a contract.

Laboratory Activity

4. Given a sample contract form, complete the agreement for building a dream house.
5. Given a mortgage loan amount and an interest rate, figure the first month's interest on the loan.

Time Schedule

5 Overview
20 Lecture
10 Discussion
10 Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1 overhead projector/screen

Supplies

1 set Transparencies 155-1, 155-2, and 155-3

Overview (5)

1. Today's reading explained three kinds of agreements or contracts for building a house. It also showed an example of a direct-reduction loan schedule.
2. I will tell you about contracting and financing to purchase and will demonstrate how interest is computed when money is borrowed to buy property.
3. You will be asked to explain something about types of contracts, lending institutions, loan applications, computing interest, and how monthly payments on a 20-year loan are scheduled.

Lecture (20)

The teacher will present some basic ideas about contracting and financing a house.

1. *Contracting* means making an agreement, and *financing* means obtaining funds.
2. Contracts for house building are of three types:
   - a. Owner-architect contract.
   - b. Owner-contractor contract.
   - c. Owner-subcontractor contract.
3. Contract documents include the following information: (Show Transparency 155-1, Residential Construction Contract)
   - a. Dates. (1, 2, 3)
   - b. Owner's name. (5, 7)
   - c. Contractor's or architect's name. (4)
   - d. Amount of the contract. (10, 11)
   - e. How the amount is to be paid (lump sum or in payments.)
   - f. A set of plans.
   - g. A list of written specifications.
   - h. The date the house is to be started and completed. (8, 9)
4. Money may be borrowed from several sources:
   - a. Private individuals.
   - b. Lending institutions.
     - 1) Banks.
     - 2) Insurance companies.
     - 3) Building and loan associations.
5. The amount of interest charged on a loan depends on the interest rate and on the length of the mortgage period, whether for 10, 20, or 30 years.
6. The interest rate affects the total amount paid.
7. Show Transparency 155-2, Residential Construction Loan Repayment Schedule. The monthly payment applies largely to the interest at the beginning, with very little going to reduce the principal. This changes slowly with each payment so that a larger part of the payment goes toward paying off the principal.
8. Explain what is meant by a "written commitment from the lending institution."
9. Demonstrate how interest is computed on an 8% loan. Be sure students understand that "8%" is another name for .08, or 8/100.

   For example:

Value of house	$25,000.00
Down payment	5,000.00
Am't. of mortgage loan	$20,000.00
Interest rate	.08
Interest for 1 year	$ 1,600.00
Interest 1st payment	$ 133.33
(1/12 of $1,600 = $133.33)	

10. Many kinds of information are asked for on a loan application. Show Transparency 155-3, Real Estate Mortgage Information.

Discussion (10)

1. Name three types of building contracts. (Owner-architect, owner-contractor, and owner-subcontractor.)
2. What information is called for on a contract? (When the work begins and ends, who does the work, payments for the work, and who is responsible for the work.)
3. What are the types of lending institutions? (Bank and savings and loan.)
4. What information is called for on a loan application? (Personal information, amount of loan and interest, location and description of property, employment record, amount of income, and schedule of payments.)
5. How do you compute the first month's interest on an 8% per year loan? (Find

.08 × total loan. Then divide by 12 for one month's interest.)

Laboratory Activity (10)

1. Each student will complete an agreement between contractor and owner to build his dream house.
2. If time permits and students have acquired the necessary math skills, have them compute the first month's interest on a dream house. (Problem 2.)

Homework

Reading 82

ASSIGNMENT 156, UNIT 82

Building the Substructure

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to building the substructure:
   a. Identify what excavation problems would limit the use of basements in your community.
   b. Give reasons why it is important to strip off and save topsoil during the clearing operation.

Discussion

2. Given the problem of constructing a residential building:
   a. Explain what is involved in clearing the site.
   b. Explain who does site layout, how it is done, and the use of batter boards.

Laboratory Activity

3. Given a floor plan and the necessary materials and equipment, cut out a floor plan, cement it to slab foundation material, and saw around the floor plan.

Time Schedule

5 Overview
10 Lecture-Discussion
5 Demonstration
25 Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1 backsaw from miter box *or* equivalent
1 pr. scissors

Supplies

1 floor plan
1 pc. 1/8" x 12" x 18" (approx.) hardboard
1 pencil
1 btl. rubber cement *or* white glue
1 sht. abrasive paper (fine)

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

5 backsaws from miter boxes *or* equivalent
10 pr. scissors

Supplies (Each student)

1 floor plan, on grid paper

Supplies (Per class)

5 btl. rubber cement *or* white glue
5 shts. fine abrasive paper
4 shts. 4' x 8' hardboard

Overview (5)

1. Today you read about the practices of clearing the site and preparing to build the substructures.
2. I will tell you what is involved in clearing a site and ask you questions about what is involved in locating a house on a site.
3. I will show you how to cut out a floor plan, cement it to a piece of hardboard, and cut it out to represent a slab foundation.
4. During the laboratory activity, you will cement your floor plan to hardboard, cut out around the exterior wall, and sand the edges smooth.

Lecture-Discussion (10)

1. In preparing a site, most obstructions are reduced to a size that can be easily handled for removal. Typical obstructions are brush, unwanted trees, rocks and existing buildings. Topsoil is removed carefully from the area to be excavated but is kept on the premises.
2. Due to storage problems, you will not be working with your lot or plot plan until after your dream house is completed.
3. Ask students if they can recall from the first semester what is involved in clearing a site.
   Some of the tasks involved in clearing the site are as follows:
   a. Brush is burned at the site or hauled away.
   b. Trees may be removed. If allowed to stand, they must be protected.
   c. Rock is removed from the site or used as fill.
   d. Buildings are removed or used for storing materials and equipment.
   e. Topsoil is stockpiled for later use in landscaping.
4. Once the site is cleared, the house can be located on the building site.
   a. Who does it? (Surveyors.)
   b. How is it done? (Checking the plot plan for measurements, and then measuring in from property boundary lines using transit and tape.)
   c. How is the location of the house marked? (With batter boards.)
   d. How do batter boards aid in construction? (Refer to the figures in the text. They give outside limits for excavation of footings and foundation walls.

Demonstration (5)

Show the students how to cut out their floor plan, cement it to the slab material, and saw out the slab.

1. Using scissors, cut out the grid-paper floor plan. Emphasize the importance of cutting to the *outside* of the wall layout as the walls will be erected flush to the outside.
2. Cement the cutout floor plan to the slab foundation material using rubber cement. Recommended size: ⅛″ x 12″ x 18″ hardboard.
3. Review the proper use of saws as you cut out the foundation slab material.

Laboratory Activity (25)

1. Distribute the necessary supplies and equipment.
2. Aid students who may need help in sawing.
3. Be sure each student writes his name on his model slab.

Note: Start to make or arrange for temporary storage shelving for storing the house models as they are developed.

Safety Precautions

Care should be taken in the safe use of the backsaw, or sabre saw if it is used.

Homework

Reading 83

ASSIGNMENT 157, UNIT 83A

Building Walls

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to building walls:
   a. Give reasons why you think 2" x 4" studs are commonly placed 16" on center in walls.
   b. Identify the style of wall construction used in your school building and state whether or not this style is often used on homes.

Discussion

2. Given a demonstration on how to lay out and cut model walls, doors, and windows, state the procedures and materials used to lay out and cut out walls.

Laboratory Activity

3. Given wall material, model house floor plans, and elevations, lay out and cut out exterior walls.

Time Schedule

5	Overview
5	Demonstration
5	Discussion
30	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	Xacto® *or* utility knife
1	try square

Supplies

4 pcs.	1/4" x 2" x 13" urethane foam wall material
1	pencil
1 set	elevation plans
1	slab foundation, from Activity 82

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

30	Xacto® *or* utility knives
10	try squares

Supplies (Per student)

4 pcs.	1/4" x 2" x 13" urethane foam wall material
1	pencil
1 set	elevation plans
1	slab foundation, from Activity 82

Overview (5)

1. The text reading described the basic kinds of walls used in construction.
2. I will demonstrate how to lay out and cut out the exterior walls for your dream house.
3. I will also show you how to lay out the widths and heights of your doors and windows.
4. You will be asked questions about the demonstration and the procedure you will use to lay out and cut out the exterior walls.
5. During the laboratory activity, you will lay out and cut to length your exterior walls and lay out the doors and windows.

Demonstration (5)

Students should be shown how to lay out and cut out the exterior walls for the dream house and how to lay out window and door openings.

1. Check one end of the wall material to be sure that it is square. Trim it to square with a utility knife if needed.
2. Lay the squared material along one wall of the floor plan. Mark and cut it 1/4" shorter than the length of the wall to allow for a butt joint. Be sure students understand the importance of making proper allowance to provide for overlapping butt joints.
3. Follow the above procedure for all the exterior walls.
4. Realign each wall section where it fits on the floor plan. Mark all window and door openings. Caution students to mark the width of each opening carefully.
5. Determine vertical window and door measurements (heights) by referring to elevation plans.

Discussion (5)

1. What are the first steps in building the walls of your model house? (Square the stock. Then lay out the wall lengths.)
2. What mark is critical in laying out the doors and windows? (The width.)

3. Which drawings will you read to get the height of windows and doors? (Elevations.)

Laboratory Activity (30)

1. Students will cut out exterior walls, window openings, and door openings.
2. Give help as needed.
3. Have students store their materials according to your directions. Materials may be stored in large envelopes labeled with the students' names.

Safety Precautions

Care must be taken in handling and storing the cutting tools.

Homework

None

ASSIGNMENT 158, UNIT 83B

Building Walls

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given demonstrations on how to cut doors and windows and how to erect walls, state the procedures and materials to be used to erect walls for their own model houses.

Laboratory Activity

2. Given the necessary equipment and supplies, assemble the wall sections of a model home on the slab foundation.

Time Schedule

5	Overview
5	Demonstration
5	Discussion
30	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	Xacto® *or* utility knife
1	try square
1	window and door cutting guide
1	overhead projector/screen

Supplies

1 set	slab foundation and walls
1 btl.	white glue
1 sht.	extra fine (8/0) abrasive paper
1	Transparency 158

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

25	Xacto® *or* utility knives
5	try squares
15	window and door cutting guides

Supplies (Per class)

300	straight pins
5 btls.	white glue
5 shts.	extra fine (8/0) abrasive paper

Supplies (Per student)

1 set	exterior walls for dream house
1	pencil
1	set elevations
1	slab foundation

Overview (5)

1. You should now have all exterior walls cut to length and all doors and windows marked.
2. I will demonstrate how to use a window and door cutting guide for cutting out your windows and doors.
3. I will also show you how to erect the exterior walls on the slab foundation of your dream house.

4. You will be asked to explain the tools and procedures for cutting out windows and doors and in erecting the exterior walls.
5. At the end of today's activity, you should have completed the erection of the exterior walls so that we can proceed with the interior walls in the next activity.

Demonstration (5)

Students should be shown how to use a window and door guide as a marking and cutting aid and how to assemble the exterior wall sections of their dream houses.

1. Using a window and door cutting guide both as a story pole and as a guide, mark and cut all openings. (See Fig. 83B-1 of the Laboratory Manual.)
2. Show Transparency 158-1, Window and Door Guide. Point out that all windows and doors can be easily marked and cut if the craftsman uses a device such as the one illustrated.
3. Demonstrate the techniques for erecting walls.
   a. If wall joints do not fit well, sand them very lightly until they fit.
   b. Erect and assemble all exterior walls using both glue and straight pins. Caution students that if these pins are left in too long, the glue will adhere to them and the wall material may be damaged when they are finally removed.
   c. Make sure all wall sections are level and plumb before setting the assembly aside.
4. Allow the glue to dry, but remove the pins before storing.

Discussion (5)

1. What device will you use to cut the doors and windows accurately? (A door and window cutting guide.)
2. How are the walls assembled to the slab foundation? (With glue and pins.)
3. How long should you wait before removing the pins? (10 to 15 minutes)

Laboratory Activity (30)

Today each student will lay out, cut and erect the exterior walls of his dream house, working from his own plans.

1. Students will lay out and cut window openings and door openings.
2. Then they will erect and assemble the walls to the slab foundation, using glue and pins.
3. Give help as needed.
4. Have students store their materials according to your directions.

Safety Precautions

Care must be taken in handling and storing the cutting tools.

Homework

Reading 84

**ASSIGNMENTS 159, 160, 161,
UNITS 84A, B, C**

Building Floors and Ceilings

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to building floors and ceilings:
   a. Identify whether or not the floors in your home are constructed of wood, frame, or concrete, and compare your floor construction to others in your neighborhood.
   b. Give reasons why metal is not a commonly used material in home floor or ceiling construction.

Discussion

2. Given a demonstration on how to lay out, cut out, and erect interior walls:
   a. State how to check a wall for squareness.
   b. State the height of interior doors and openings they will use.

Laboratory Activity

3. Given a floor plan and the necessary equipment and supplies, lay out, cut, and erect the interior walls of the dream house.

Time Schedule, 159

5 Overview
10 Demonstration
5 Discussion
25 Laboratory Activity

Time Schedule, 160, 161

45 Laboratory Activity
45 Laboratory Activity

Equipment and Supplies for Demonstration

The teacher will use the equipment and supplies needed for one student to demonstrate the procedure students will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

10 try squares
15 door and window cutting guides

Equipment (Each student)

1 Xacto® *or* utility knife

Supplies (Per class)

300 straight pins
5 btls. white glue
5 shts. extra fine (8/0) abrasive paper

Supplies (Each student)

4 pcs. 1/4" x 2" x 13" interior wall material
1 floor plan tracing
1 slab foundation with exterior walls

Overview (5)

1. Your reading described how flooring systems are used and how these systems relate to ceilings.
2. I will demonstrate how to lay out, cut, and install your interior walls.
3. You will be expected to answer questions about the procedure used for cutting openings and installing interior walls in your dream house.
4. It is important that you work as accurately and industriously as possible so you will complete the exterior and interior walls before the roofing activity begins.
5. The laboratory activity for today and the next two class periods will involve laying out, cutting, and building the interior walls of your dream house.

Demonstration (10)

1. Review with the students how to mark off wall material to length, allowing for the butt joints where walls meet.
2. Explain that interior doorways are to be the same height as exterior doors.
3. Apply glue to two sections of interior wall, and assemble them in place.
4. Demonstrate how to cut out and install a short wall for a closet or bathroom.

Discussion (5)

1. How do you know if the end of a wall is square? (By testing with a try square.)

2. What is the height of interior doors and openings? (6′8″, same as exterior doors.)
3. If you made interior wall material thinner than ¼″, what allowances would have to be made in cutting sections to length and placing them into position on the floor plan? (Cut them a little longer and place them in the center of the existing layout for the wall.)

Laboratory Activity (25)

Note: Students have three days to complete this activity.

1. Students who have not completed the erection of the exterior walls at this point should receive some extra help from the teacher or another student who has completed the activity.
2. Today and during the next two activities, students are to complete the exterior and interior walls of the dream house.
3. Give individual help and review instructions as necessary.
4. Emphasize the importance of completing all exterior and interior walls on schedule before starting roofing.
5. Have students store their models according to your directions.
   Note: The teacher might devise a jig that students could use to sand all interior wall material to 3/16″ thickness or less before cutting it out, if desired.

Homework

After Activity 84C, assign Reading 85.

ASSIGNMENT 162, UNIT 85A

Building Roofs

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to building roofs:
   a. Identify what style of roof your home has and compare it to the roof styles of your neighbors' houses.
   b. Describe how the seasons and weather affect roof design in your city.

Discussion

2. Given a demonstration on laying out and cutting roof trusses and sheathing:
   a. Explain the terms "run," "rise," and "span."
   b. Tell how to make a template for a roof truss.
   c. Explain how to determine the size of roof sheathing.

Laboratory Activity

3. Given a model structure, plans, equipment, and supplies, lay out and cut out roof trusses and roof sheathing for the dream house.

Time Schedule

5	Overview
15	Demonstration
5	Discussion
20	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	Xacto® *or* utility knife

Supplies

1 pc.	extra fine abrasive paper (8/0)
2 pcs.	¼″ x 12″ x 24″ (approx.) urethane plastic for roof
2 pcs.	¼″ x 2″ x 8″ urethane plastic for gables

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

5	T-bevels
5	framing squares
5	try squares
25	Xacto® *or* utility knives

Supplies (Per class)

250	straight pins
5 shts.	extra fine abrasive paper (8/0)

Supplies (Per student)

2 pcs.	1/4″ x 2″ x 8″ (approx.) roof material for gable ends
2 pcs.	1/4″ x 12″ x 18″ (approx.) for roof
1 set	elevation plans
1	incomplete model house
1 pc.	3″ x 10″ posterboard

Overview (5)

1. The text reading described styles of roofs, roof framing terms, and the construction of different types of roofs.
2. I will demonstrate how to lay out and cut roof trusses for your dream house and how to sand one edge of each roof piece to form the angle for the roof ridge.
3. You will be asked to identify some of the common terms used in roof construction.
4. You will be asked questions about the procedure used to cut out and assemble roof trusses and roof sheathing.
5. During your laboratory activity, you will begin building the roof section of your dream house.

Demonstration (15)

Today the teacher will demonstrate laying out and cutting roof trusses and sheathing, and assembling roof sections.

1. Determine the slope from elevation plans, and develop a truss pattern.
2. After cutting trusses, check them for fit and temporarily fasten them in place with straight pins.
3. Determine the size of roof sheathing pieces as follows: obtain length and width measurements, add the amount needed for all overhang, and allow the amount needed for the ridge angle.
4. Cut to size with a utility knife, and sand the ridge edges to the desired angle.
5. Check for fit at ridge and overhang, and make any necessary alterations.
6. Assembly of roof will consist of gluing and pinning sheathing to trusses, and gluing sheathing together at ridge or valley. Trusses *will not be glued* to wall sections. This will permit the entire roof section to be removed.

Discussion (5)

1. What is the *span* of a roof? The *run?* The *rise?* (*Span* is the distance between bearing points of the wall frame; *run* is the horizontal distance from one bearing point to a point dropped vertically from the ridge intersecting the span distance; *rise* is the vertical distance or height of the roof from the bearing point to the ridge.)
2. How will you get the proper angle on a gable end or truss? (Make a pattern from an elevation.)
3. How will you get the roof to come together at the ridge? (Sand lightly at the proper angle along the upper edges.)

Laboratory Activity (20)

1. Students are to make a template of a roof truss from their elevation drawings and then lay out and cut out trusses.
2. They will then cut their roof pieces to length and width, and sand edges to form a tight fit at the ridge.
3. Note: The teacher may want to build an adjustable ridge angle cutting and sanding jig to aid students in this task.
4. Give help as necessary.
5. Have students store their models according to your directions.

Homework

None

ASSIGNMENT 163, UNIT 85B

Building Roofs

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a demonstration, those students who have planned an intersecting gable roof will lay out and fit the roof for their dream house.
2. Given model structure plans, equipment, and supplies, assemble the roof section for a dream house.

Time Schedule

5	Overview
10	Demonstration
30	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	Xacto® *or* utility knife
1	12″ rule

Supplies

1	gables A and B assembled prior to class, from demonstration materials in 85A
1	pencil

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

5	T-bevels
5	framing squares
5	try squares
25	Xacto® *or* utility knives

Supplies (Per class)

250	straight pins
5 shts.	extra fine abrasive paper (8/0)

Supplies (Per student)

1 set	elevation plans
1	incomplete model house

Overview (5)

1. Yesterday you began building the roof for your dream house.
2. Today I will demonstrate how two gables that intersect will be developed and fitted together.
3. During the laboratory period, you will assemble the roof sections for your dream house.

Demonstration (10)

Prior to class, prepare two gabled roofs that will be a sample of intersecting gable roofs as shown in Fig. 85B-3 in the Laboratory Manual.

1. Lay roof gable sections A and B on a flat surface into the location in which they will intersect (as shown in Fig. 85B-3 in Laboratory Manual.)
2. Using a piece of cardboard as a straightedge, draw a line on the intersecting roof "B" parallel to slope of roof "A" (as shown in Fig. 85B-3 in Laboratory Manual).
3. Mark both sides, cut and sand to fit, and pin in place to show students (as shown in Fig. 85B-4 in your Laboratory Manual.)
4. Demonstrate to students how penciled grooves on their roof can symbolize shingles as shown in Fig. 85B-5 in your Laboratory Manual. This technique can be used if roof papers or other simulated materials are not available.

Laboratory Activity (30)

1. Have students assemble their roof sections with pins and glue.
2. Give additional help to those students with special types of roofs.
3. Students who have completed their roof sections should give some consideration to design and decoration to simulate roofing materials.
4. Have students store model houses according to your directions.

Homework

None

ASSIGNMENT 164, UNIT 85C

Building Roofs

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a model house and supplies, complete the roofing.
2. Given information about suggested materials that can be used for landscaping, begin looking for materials that can be utilized.

Time Schedule

5	Overview
10	Lecture
30	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

25	Xacto® *or* utility knives
5	T-bevels
5	framing squares
5	try squares

Supplies (Per class)

5 btls.	white glue
300	straight pins
5 shts.	extra fine abrasive paper (8/0)

Supplies (Per student)

1 set	elevations
	1/4" urethane plastic, as needed
1	incomplete model house

Overview (5)

1. Most of the period will be used in completing the roofing for your dream house.
2. I will spend the last few minutes of the period discussing with you some of the materials you can use for landscaping your dream house lots.

Lecture (10)

1. Using Chart 85C-1 in the Laboratory Manual as a guide, explain how various materials can be used to simulate grass, trees and bushes, gravel, paths, etc.
2. Point out to the students that if they use their imaginations, they may find other items that will make the landscaping more interesting and attractive.

Laboratory Activity (30)

1. Students are to complete the roofing for their dream houses.
2. Explain that roofing must be completed before the next class period so that painting and decorating can begin.
3. Those students who are finished may help others to catch up today.
4. Store models.

Homework

Reading 86

ASSIGNMENTS 165, 166
UNITS 86A, B

Enclosing Exteriors

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to enclosing exteriors:
   a. Identify what building material for exterior walls is most common in your neighborhood.
   b. Describe how exterior walls of a home might be covered 30 years from now, and tell why they might be covered that way.

Discussion

2. Given a lecture-demonstration on finishing and finishing materials, answer questions about the following:
   a. Types of paint.
   b. Thinners for paints.
   c. Application of paints on surfaces.
   d. Care of brushes.

Laboratory Activity

3. Given tempera paint, paint the roof of the dream house.
4. Given latex paint, paint the exterior walls of the dream house.

Time Schedule, 165

5	Overview
10	Lecture-demonstration
5	Discussion
25	Laboratory Activity

Time Schedule, 166

45	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	1½″ paint brush

Supplies

1 pt.	tempera paint
1 pt.	latex paint
	urethane plastic scraps
	8 oz. paper cup *or* equiv.
	stirring sticks

Equipment and Supplies for Laboratory Activity

Equipment (Class)

15	1½″ paint brushes
25	artists' paint brushes

Supplies (Per teacher)

8 lbs. powdered tempera (assorted colors)
8 qts. latex paint (assorted colors)
3 qts. liquid detergent

Note: The teacher should prepare the paints before class. The latex paint should be mixed: 1 qt. detergent to 4 qts. paint. Proportions for preparing tempera paint are approximately 1 part powder, 3 parts water, and 1 part liquid detergent.

Supplies (Each student)

1	model house
2	8 oz. paper cups or equivalent for paint

Overview (5)

1. You have read about sheathing, windows, doors, louvers, and finished siding and how they are applied or installed.
2. Today I will demonstrate and explain the proper use of some finishing materials.
3. You will be asked questions about finishing materials and their use.
4. During the next two days, you will paint the exterior walls and roof of your "dream house."

Lecture - Demonstration (10)

Display any of these materials that you have on hand: oil paint, latex paint, shellac, varnish, turpentine or mineral spirits, and alcohol.

1. Applying a finish to a structure protects and beautifies the surface. Many kinds of paint, varnish, or shellac may be used for this purpose.
2. Often it is necessary to thin paint, or other finishing materials, before applying them to the structure. Show the various finishing materials. Explain how each is thinned and the need for following the directions on the can.
3. Demonstrate by placing small amounts of various paints and varnishes in containers, adding various solvents, and stirring. Shellac will not mix with turpentine or

water. Some paints will not mix with water, but latex paints usually can be thinned with water.
4. A paint brush should never be loaded with a large amount of paint. Too much paint on the brush causes splashes and spills. Demonstrate with scrap material how to paint with tempera and latex paint.
5. There are rollers, spray devices, and special brushes for some painting tasks.
6. Proper care of equipment is important. Ruining brushes by letting paint, shellac, or varnish harden on them or by letting the bristles dry bent and crooked is very wasteful. Review techniques of cleaning and wrapping brushes.

Discussion (5)

1. What types of paint will you be using on your dream house? (Tempera and latex).
2. How is thinner used? (To thin the paint, varnish, or shellac. To clean spilled paint. To clean brushes.)
3. What are some of the tools for applying paint on surfaces? (Brushes, rollers, spray devices, etc.)
4. Why is it important to clean a brush properly after each use? (Hardened paint, varnish, or shellac ruins a brush or makes it very hard to clean.)

Laboratory Activity (25)

1. Prepare the paint-detergent mixtures before class. (The same paint can be used the next day.)
2. Some students may begin by painting the roofs of their dream house models with tempera paint (Problem 1). The others may begin by applying latex paint to the exterior walls (Problem 2).
3. Students may use the following day to complete this activity.
4. Have students clean up and store their models according to your directions.

Safety Precautions

1. Protect the work area with plastic sheeting or newspapers.
2. Students should protect clothing with shop aprons.

Homework

None

ASSIGNMENT 167, UNIT 87

Roughing in Utilities

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to roughing in utilities:
   a. Give reasons why the heating utilities are roughed in before plumbing or electrical utilities.
   b. When homes are built in factories, explain whether or not utilities will be installed on the site or in the factory and explain where utilities will be connected.

Discussion

2. Given a demonstration, state how to cut and install windows and doors for the dream house.

Laboratory Activity

3. Given working drawings, equipment, and supplies, prepare and install windows, doors, and miscellaneous fixtures in the dream house.

Time Schedule

5	Overview
10	Demonstration
10	Discussion
20	Laboratory Activity

Equipment and Supplies for Demonstration

The instructor will use the equipment and supplies needed for one student to demonstrate the procedure students will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Each student)

1	Xacto® *or* utility knife
1	architect's scale

Supplies (Each student)

1 pc. scrap ¼″ urethane sheet *or* assorted pieces of colored construction paper
1 set elevation drawings

Supplies (Per class)

5 shts. transparent plastic window material
5 btls. white glue or rubber cement
5 shts. 8/0 fine abrasive paper

Overview (5)

1. Your text reading explained how utilities are roughed in.
2. Today I will demonstrate how to cut, fit, and install the windows and doors for the dream house.
3. You will be asked questions about the building materials that normally would be installed on the interior of a structure.
4. During the laboratory activity you will cut, fit, and install the windows and doors for your dream house. If time permits, you may also make and install some fixtures.

Demonstration (10)

Today the teacher is to demonstrate cutting and installing windows and doors.

1. Measure a window opening; cut plastic window material about ¼″ longer and wider than the opening.
2. Apply a small amount of glue or rubber cement on all corners of the plastic window, and attach it to an inside wall so as to cover the window opening.
3. Explain that glass doors should be treated as windows.
4. Measure an outside door opening, and cut a scrap piece of urethane foam material to fit.
5. Sand the door material to reduce its thickness nearly to scale. (It should be about ⅛″ thick.)
6. Apply glue to one side and one end of each door, and install it in place, slightly open in the direction indicated on the floor plan.

Discussion (10)

Recall with your students the wood frame structure they constructed. Review the construction of the various utility systems: heating, cooling and ventilating systems; plumbing and piping; electrical power; and communications.

1. What must heating, cooling and ventilating systems provide?
   a. An intake for fuel or power (gas, oil, or electricity).
   b. Equipment for converting the fuel or power to heat.
   c. A means of circulation (ductwork, pipes, wires).
2. What must plumbing systems provide?
   a. Tapping into a source of water.
   b. Connecting into an outlet for removal of waste.
3. What must electrical systems provide?
   a. Entrance of electricity.
   b. Safety devices such as fuses or breakers.
   c. Branch circuits and outlets.

Laboratory Activity (20)

1. Students will cut transparent plastic sheeting and cement it to the inside walls to cover openings.
2. Using either urethane foam sanded to ⅛″ or posterboard, students will cut and install exterior doors.
3. If time permits, suggest to students that they may develop some of the fixtures and hardware shown in Fig. 87-4.
4. Store models.

Homework

Reading 88

ASSIGNMENT 168, UNIT 88

Working on the Interiors

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to working on the interior:
   a. Name the different types of tradesmen or craftsmen that would be employed to *finish out* a newly built home.
   b. Name what interior work, if any, can be done during or before exterior work and the *roughing in* of utilities, and explain why.

Discussion

2. Given a series of questions:
   a. Name some of the forms of insulation materials.
   b. Name some techniques of enclosing walls and ceilings.
   c. Identify the trim pieces used in door construction.

Laboratory Activity

3. Given a model house, working drawings, equipment and supplies, complete the exterior of the dream house.

Time Schedule

5	Overview
5	Discussion
35	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

25	Xacto® *or* utility knives
5	12″ rules
5	architect's scales
5	try squares

Supplies (Per class)

5 shts.	plastic window material
5 shts.	veneer material
	scrap 1/4″ urethane sheet
	assorted pieces of colored construction paper
	scrap wood
5 btls.	white glue *or* rubber cement
5 shts.	8/0 fine abrasive paper
300	straight pins

Supplies (Each student)

1 set	working drawings
1	model house

Overview (5)

1. The text describes the various practices and materials used in finishing the interior of a house.
2. You will be asked to name some of the materials used in finishing interiors.
3. During the laboratory activity, you will complete the exterior of your dream house.

Discussion (5)

1. What are some of the forms of insulation materials? (Batts, blankets, rigid slabs, loose fill, and aluminum and copper foil.)
2. Name some techniques of enclosing walls and ceilings. (Lath and plaster walls, drywall, paneling, etc.)
3. Identify the trim pieces used in door construction. (Casing, jamb, stop, butts, etc.)

Laboratory Activity (35)

1. Students will measure, cut, and install brick or stone veneer, and complete the exterior of their dream house.
2. Students who have the exterior trim, doors and windows completed, will start cutting out and installing the interior doors, fixtures, and hardware.
3. Store models.

Homework

Reading 89

ASSIGNMENT 169, UNIT 89

Completing the House

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to completing the house:
   a. Give reasons why fixtures and accessories should not be installed before painting and decorating.
   b. List the different fixtures and accessories that are in your kitchen and identify what room in your house has the most fixtures and accessories.

Discussion

2. Given a series of questions:
   a. Define what is meant by "decorative coating."
   b. Name three general kinds of cabinets.
   c. Explain why the careful installation of fixtures and accessories is so important.

Laboratory Activity

3. Given a model house, equipment, and supplies, complete the interior of the dream house.

Time Schedule

5	Overview
10	Demonstration
5	Discussion
25	Laboratory Activity

Equipment and Supplies for Demonstration

The teacher will use the equipment and supplies needed for one group of students to demonstrate the procedure they will follow.

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

5	12″ rules
5	architect's scales
5	scissors
25	Xacto® *or* utility knives

Supplies (Per class)

5 btls.	glue
5 btls.	rubber cement
300	straight pins
5 shts.	8/0 abrasive paper

Supplies (Per student)

1	model house
	scrap building materials

Overview (5)

1. The text described the steps remaining to complete a house: painting, decorating, and installing accessories and fixtures.
2. I will show you how to make some of the fixtures and components that you would put in the interior of your dream house.
3. You will be asked to identify decorating coatings, cabinets, fixtures, and accessories.
4. During your laboratory activity you will complete the interior of your dream house.

Demonstration (10)

Finishing interiors can include installation of trim, stairs, interior doors, paneling, veneer, bathroom fixtures, kitchen cabinets, etc. You may wish to prepare, for example, a chimney or set of base and wall cabinets. For such items, pieces of urethane foam are glued together, then cut and sanded to a desired shape.

Discussion (5)

1. What is meant by "decorative coating?" (Paint and wallpaper.)
2. What are the three general kinds of cabinets? (Base units, wall units, and full length units.)
3. Why is the careful installation of fixtures and accessories so important? (These are exposed items: they will be seen, so they influence the total "look" of the house.)

Laboratory Activity (25)

1. On this final day for constructing the dream house, the students may wish to add glass walls, stairways, flooring, sinks, bathtubs, kitchen cabinets, and other extra items as time permits.
2. Store models.

Homework

Reading 90

ASSIGNMENT 170, UNIT 90A

Landscaping Homesites

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to landscaping homesites:
   a. Describe what effect weather or climate has on landscaping.
   b. Give reasons why landscaping is usually the last step in completing a new home.

Discussion

2. Given a landscape plan:
   a. Identify what is meant by accesses or features.
   b. State who does landscaping and what the last steps are in finishing a site.

Laboratory Activity

3. Given a site board, plot plan, construction paper "lawn," and dream house:
   a. Secure the construction paper to the site board.
   b. Glue the dream house onto the site according to the plot plan.

Time Schedule

5	Overview
5	Lecture
5	Discussion
30	Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1	overhead projector/screen

Supplies

1	Transparency 170

Equipment and Supplies for Laboratory Activity

Equipment (Class)

25	12″ rules
5	desk staplers w/staples

Supplies (Class)

5 btls.	white glue

Supplies (Each student)

1	16″ x 24″ site board
1 sht.	18″ x 24″ green construction paper

Overview (5)

When the structure is finished, the site must be landscaped and all tools and equipment removed.

1. You have studied in your text how landscapers use a plan to grade the site and plant trees, shrubs, and grass.
2. Today we will examine a landscape plan and how landscape material is planted.
3. You will be asked questions about landscaping homesites.
4. You will receive a site board and fasten some green paper to it which will represent the grass.
5. You will use your plot plan to locate the house on the site, and then glue your house in place.

Lecture (5)

1. Show Transparency 170, Landscape Plan. Here is a typical landscape plan. Explain how trees, shrubs, grass, accessories, and features are shown.
2. Review the planting of trees and shrubs as given in the text.
3. Review the planting of grass by seeding, sodding, and sprigging.
4. Following the landscaping, the contractor must remove all equipment, temporary facilities, and dispose of all debris.

Discussion (5)

1. What do we mean by "accesses?" (Driveways, walks, and parking areas.)
2. What do we mean by "features?" (Patios, fences, pools, lights, plant boxes, etc.)
3. Who usually does the landscaping? (A landscape contractor. The owner may wish to do his own landscaping.)
4. What is the last step in finishing the site? (Removing all tools, equipment, temporary facilities, and debris.)

Laboratory Activity (30)

Today's activity is the first of three that will concern landscaping and finishing the site.

1. The students will fasten green construction paper or other material to the site boards, to represent grass.
2. Each student will use his plot plan to locate the house on the site. Note: the plot plan is drawn to 1/8″ scale, and the site must be laid out to 1/4″ scale.
3. The students will glue their houses to the site.
4. Store models.

Homework

Bring in materials to landscape your dream house.

ASSIGNMENT 171, UNIT 90B

Landscaping Homesites

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given rules, scissors, and construction paper, the students will lay out, cut out, and install driveways, sidewalks, and features.

Time Schedule

5	Overview
5	Demonstration
35	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1	12″ rule
1 pr.	scissors

Supplies

1 sht.	9″ x 12″ construction paper, black
3 shts.	9″ x 12″ construction paper, assorted colors
	other materials available for accessories and features

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

25	12″ rules
25 pr.	scissors

Supplies (Per class)

5 btls.	white glue
20 shts.	9″ x 12″ construction paper, black
10 shts.	9″ x 12″ construction paper, assorted colors
	other appropriate materials for driveways or sidewalks

Supplies (Each student)

1	model house, mounted on site board

Overview (5)

1. Today I will demonstrate how to lay out and install driveways, sidewalks, and features.
2. During the activity period, you will lay out and install the driveways, sidewalks, and other features of your choice.
3. Any features that are not finished this period must be finished as homework.
4. I will review with you the list of landscape materials shown in Laboratory Activity 85C. Any of these materials that you wish to use must be brought to class tomorrow.

Demonstration (5)

1. Using a rule and a dream house, demon-

strate how to lay out a driveway and a sidewalk.

2. Demonstrate how to cut out and glue driveway and sidewalk material.
3. Have an assortment of features such as windows, boxes, lamps, and fences, made up prior to class time for today's demonstration.

Laboratory Activity (35)

1. Students are to use pencils and rules to draw the sidewalks and driveways on their site. Then they are to cut out these accessories from construction paper and glue them in place.
2. The students will then develop landscaping features and glue them in place.
3. If the students do not finish the landscaping during class, they should finish the activity as homework.
   Note: Students should take their dream houses home at the end of the period unless optional Assignment 172 is used. If Assignment 172 is not used, it is suggested that you arrange for a display of the houses along with a set of working drawings in appropriate areas of the school and/or community.

Homework

If optional Assignment 172 is used, there is no homework. If optional Assignment 172 is not used, bring in textbooks for review (optional) if it is used. If optional review is not used, there is no homework.

ASSIGNMENT 172, UNIT 90C (OPTIONAL)

Landscaping Homesites

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a plot plan, site board, lichens and other landscape materials, landscape their homesites.
2. Given a list of criteria, evaluate their dream houses.

Time Schedule

5	Overview
10	Demonstration
30	Laboratory Activity

Equipment and Supplies for Demonstration

Equipment

1 pr.	scissors

Supplies

1 btl.	white glue
2 pcs.	lichen (to be used for shrubs and trees)
1	list of criteria for student self-evaluation of dream house

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

25 pr.	scissors

Supplies (Per class)

1 box	lichens
5 btls.	white glue
	other landscape material as available

Supplies (Each student)

1	model house
1	plot plan

Overview (5)

1. I will demonstrate how to place trees and shrubs on your plot.

2. You will finish landscaping by putting in the shrubs and trees.
3. During the last part of the period, you will have an opportunity to self-evaluate your dream house.
4. The teacher should then tell the students when they may take their dream houses home.

Demonstration (10)

Demonstrate how to set the shrubs, trees, and other available landscape material.

1. Cut five pieces of lichen about 3/4″ long to set in front of the house.
2. Cut two pieces of lichen about 1 1/4″ long to place at the front corners of the house.
3. Glue these pieces in place.
4. Set trees or other materials in place. Explain that any student who brought in materials should glue them in place.

Laboratory Activity (30)

1. The students will prepare their shrubs, trees, and other landscape materials and glue them in place.
2. The students should judge their dream houses according to Chart 90C-1. You may want to add or delete some items. Determine how you may want the students to respond to the questions. Have some students tell how they could improve their dream houses.

   Note: Students should take their dream houses home at the end of the period. It is suggested that you arrange for a display of the houses along with sets of working drawings.

Homework

If optional Assignment 173 is used, have students bring their textbooks to class. If the option is not used, have students study for the test.

ASSIGNMENT 173 (OPTIONAL)

Review 81–90

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given the summaries of Readings 81 to 90, ask and answer questions about financing and contracting, building substructures, exterior and interior walls, roofing, painting, enclosing exterior and interior walls, utilities, and landscaping.

Time Schedule

45 Discussion or Laboratory Activity

Discussion or Laboratory Activity (45)

This review time can be used in various ways. Plan to do one of the following alternatives.

Alternatives

1. Students can play the "Big Builder" game to become more familiar with the concepts and processes of construction.
2. Pose the questions and situations at the end of each reading to stimulate thinking and discussion.
3. Have each "group" of students get together and list two or three words or concepts they would like to have explained or discussed. Discuss and clarify the concepts.
4. Ask a guest speaker, knowledgeable about house finishing or landscaping to talk to the class. Schedule the speaker for the first class period and tape record his talk so it can be played to your other classes.
5. Schedule a field trip to a house that is being finished or trimmed.

Homework

None

ASSIGNMENT 174

Test No. 9

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given IACP Construction Test No. 9, select the correct responses from a list of items related to concepts presented in Readings 81 to 90.

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

1. Seat the students to best advantage for administering a test.
2. Distribute pencils, erasers, and eraser shields.
3. Distribute answer sheets and have students fill in the needed information.
4. Pass out test booklets. "Keep closed until I say begin."
5. Read directions for filling in answers. Open test booklets and begin.
6. Allow 35 minutes for completion; then collect answer sheets, then test booklets.
7. Review the test with students to provide feedback.

Homework

Reading 91

Answers for Test No. 9

1. C	2. B	3. B	4. B	5. B	6. A	7. B	8. D	9. B
10. C	11. D	12. B	13. A	14. B	15. B	16. D	17. B	18. C
19. D	20. B	21. A	22. C	23. C	24. C	25. A	26. D	27. B
28. D	29. C	30. A	31. B	32. B	33. B	34. C	35. B	

ASSIGNMENT 175, UNIT 91

City and Regional Planning Factors

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to city and regional planning factors:
   a. Describe the plans you know of that manage (plan, organize, and control) the growing population in your community.
   b. Name some of the primary construction objects in your community, and identify when they were built.

Laboratory Activity

2. Given a scaled topographic map of a community, identify the bridges, railroads, rivers, and roads.
3. Given the Apollo County map and charts, select a site and figure a land price for the Sonic Jet Plant.

Time Schedule

5 Overview
15 Lecture
25 Laboratory Activity

Equipment and Supplies for Lecture and Laboratory Activity

Equipment

1 overhead projector/screen

Supplies

1 set Transparencies 175-1, 175-2, 175-3, 175-4, 175-5

1	sponge and dish (for moistening playing pieces)
1	4′ x 4′ game board for mounting Apollo County map (plywood, hardboard, insulation board, etc.)
1	4′ x 4′ Apollo County map
1	Sonic Jet site marker

Overview (5)

1. Your text reading discussed the creating of primary construction and how this construction caused the surrounding area to develop into a new community.
2. In our laboratory activity, we will be selecting the location and figuring the land cost for primary construction of a jet engine manufacturing plant.
3. Once the primary construction site has been established the next 2 weeks you will be planning to construct a community. Some of the common constructed projects you will plan for construction are houses, streets, schools, utilities, parks, central businesses, shopping centers, and community services.

Lecture (15)

1. The first construction in an area that creates employment is "primary construction." It is the primary construction and the people employed there that cause the area to develop into a community.
2. There are five general *needs* that cause primary construction to be built. (Show Transparency 175-1, Needs That Cause Primary Construction. Using a piece of paper over the transparency, reveal an item at a time.) Also refer to Fig. 175-1.
3. Primary construction must meet three construction factors: demand, service, and site. (Show Transparency 175-2, Construction Factors. Do not use overlay.)

Demand	**Service**	**Site**
Number ____	Access ____	Soils ____
Type ____	Space ____	Slope ____
Activity ____		Price ____

There must be a *demand* for the type, exact characteristics, and number of things to be constructed. It must have *services* to operate and must be well located to serve other objects and people. It must be located on a *site* with a slope, soil, and price that permit economical construction.

4. The game board represents Apollo County which is divided into four townships. Each square on the map is a 10-acre tract of land that has a code number: for example, *X4*. (Point out the following: Ray River, the railroad, the two state routes, the county roads, location of the bridges.) Each 10-acre tract has a slope and a soil type noted on it.
5. What kind of soil does tract W3 have? (Soft.) What is the land slope of tract J1? (Flat.)
6. All roads are two-lane farm roads.
7. Are there any questions about the game board?
8. What is the first thing we'll need in this area to start the community construction process? (Primary construction: something built to fulfill a demand that also causes employment!)
9. Well! Guess what's in today's newspaper? (Read News Report 1 to the class.)

News Report 1

THE APOLLO COUNTY
HERALD-DISPATCH

Sonic Jet Company to Build Plant Here

Sonic Jet Company President John Smoothdome today announced that his com-

Fig. 175-1. Needs That Cause Primary Construction

Need for:	**Examples of Resulting Primary Construction:**
a. Use of natural resources	A mine
b. Change in transportation	Gas station and motels at highway interchange
c. Place to manufacture things	A factory near the resources or market
d. Defense from enemies	An airstrip for jet fighter planes
e. Political action	A state capitol building

pany will build a multimillion-dollar plant in Apollo County.

Sonic Jet, which specializes in the manufacture of jet engines for small aircraft, chose the Apollo County area because of its good location, and its available resources.

In the vicinity of Apollo County are the Trekcam City and Meyerville aircraft assembly plants. Sonic Jet officials believe that their company's product will have a market in these two towns. (Show Transparency 175-3, Apollo County Map.)

Dixon City, the home of a steel fabrication plant, and Turner Junction, where electrical equipment for jet engines is made, are expected to be suppliers for the proposed Sonic Jet plant.

Dixon City, Meyerville, and Trekcam City are a short railroad distance from the Apollo County location. Turner Junction can be conveniently reached by road.

In addition to its nearness to important towns, there is a riverfront at the Apollo County location. The Ray River will supply the water required for use in the industrial process.

Mr. Smoothdome pointed out that Sonic Jet will purchase a 40-acre plant site, consisting of four 10-acre tracts. Such a square site, he said, would permit easy site development.

The Sonic Jet president stated that the 40-acre site *must* have:

a. One side next to railroad.
b. One side next to river.
c. One side next to state road.

Commenting on the necessary ground conditions, Mr. Smoothdome stated, "Soils are critical. The site should be flat with hard or firm soil." He emphasized that the plant will be extensive and contain very heavy equipment that will require good support by soils on the site. Smoothdome also said that Sonic Jet was interested in a low-priced site and that site development will be simplified if the same soils exist throughout the 40-acre site. Construction of the plant will begin as soon as the site is purchased.

10. Reemphasize the requirements for locating a site and constructing the Sonic Jet plant. Guide them through the "Demand, Service, Site" chart on Transparency 175-2, filling in the material underlined as follows. Use Transparency 175-2 w/overlay. **See Fig. 175-2.**
11. One industrial plant for the production of jet engines will be built so the "Demand" factors will be met. (Place a check mark in front of each of the three "Demand" factors on Transparency 175-2 with overlay.)
12. Groups of four 10-acre square tracts that have a railroad on one side, a state route on one side, and a river on at least one side must be found in order to meet the "Service" factors. When you have found these qualities, you must first check to see that they have all hard *or* all firm soils, and that all of the tracts are flat. Then the groups of four tracts that meet these conditions must be checked to see which group has the lowest land price. This group will then meet the requirements for the Sonic Jet plant.

Laboratory Activity (25)

1. Open your Laboratory Manuals to Activity 91. In Chart 91-1, seven groups of tracts have been selected for you. These groups of tracts meet all of the "Service" factors because they have a railroad on one side, a state route on one side, and a river on one side. (Point out one site that has the above requirements and one that does not, using the gameboard.)
2. Use maps in back of Laboratory Manual to complete Chart 91-1, or refer to gameboard.
3. You must now check the "soils" and "slope" qualities of the "Site" factor in Chart 91-1. (Point to W3, W4, W7, W8

Fi 175-2. Construction Factors

Demand
Number: *one*
Type: *an economical place to manufacture products.*
Activity: *manufacture jet engines.*

Service
Access: *one side of R.R., one side on river, one side on state road.*
Space: *four 10-acre tracts in a square group.*

Site
Soil: *hard or firm* (but all same type on the 4 tracts)
Slope: *flat*
Price: *low*

on the gameboard.) Are all four tracts flat? Record "Yes" or "No" in Chart 91-1. Do all four tracts have firm or hard ground? Record "Yes" or "No" in Chart 91-1. (Show Transparency 175-4, Potential Sites for Sonic Jet Plant, without overlay.) Do the tract Nos. W3, W4, W7, W8 meet both of the conditions? (No.)

4. Now, do the same for the other six tract groups. (Illustrate on Transparency 175-4 by flipping over overlay after students are finished.)
5. Do any of these 40-acre tracts meet *both* of these conditions? (Yes.) Which tract numbers? (Tracts Y1, 2, 3, 4, and D1, 2, 3, 4.) Either of these groups could be the site of the Sonic Jet plant. One will be the site. To find out which site is most economical to develop you must determine the land price.
6. (Show Transparency 175-5, Land Price of Tract Group, without overlays.)
   a. Since nothing is developed in the primary construction site area, only *land* and *transportation* factors are included in Chart 91-2. (Have half the class complete Chart 91-2 using Tracts D1, 2, 3, and 4 and the other half complete Chart 91-2 using Tracts Y1, 2, 3, and 4.)
   b. A flat, hard tract of land is usually the most desirable for construction because it requires very little alteration. Since this type of land is in greater demand, the developer will usually have to pay a higher price for it.
   c. If the tract is flat, enter $10,000 in the space under the Tract No., if sloped $10,000, if steep $5,000. Enter $15,000 for hard soil. In Chart 91-2 under *Transportation Factors* you must add $10,000 for *each side* that is bordered by either a river, road or railroad. For example: The river borders Tract No. Y1 on 2 sides, therefore ($10,000 × 2 = $20,000). $20,000 must be placed under the Y1 column next to "River" in Chart 91-2. You must do this for *each* of the four tracts in your tract group. Are there any questions concerning how to find the land price of a tract? Complete Chart 91-2. (Show Transparency 175-5 with overlay for D tracts and overlay for Y tracts.)
7. Enter total cost of all four tracts in Chart 91-3. Circulate around the room while they are completing Chart 91-2 to answer questions. **Note:** Each of the four tracts has a land price of $40,000.
8. Raise your hands when finished. (Both D1, 2, 3, and 4, and Y1, 2, 3, and 4, should have the same land price—$160,000.) Since there is no difference in land price, you can select either site. Which tracts do you want as the site for the Sonic Jet plant? (If they cannot agree quickly pick one of the groups to save time.) Write in the tract numbers selected by the class in Chart 91-4. (Read off the tract numbers to be sure that all students have the same numbers.)
9. Select the "Sonic Jet Plant" playing piece and locate it on these tracts, announcing that the Sonic Jet plant is now under construction.
10. Record the Sonic Jet plant site on the map in the back of your Laboratory Manual.
11. Store your Laboratory Manuals.

Homework

Reading 92

ASSIGNMENT 176, UNIT 92

Planning Community Services

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to planning community services:
   a. Describe what could be done to move automobile traffic faster.
   b. Identify the source of your drinking water and explain why there is or is not a shortage of water.

Laboratory Activity

2. Given the Apollo County map:
   a. Determine appropriate water plant and sewage plant sites.
   b. Estimate the capacity and cost of water and sewage utilities.

Time Schedule

5	Overview
15	Lecture
25	Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1	overhead projector/screen

Supplies

1 set	Transparencies 176-1, 176-2, 176-3, 176-4, 176-5
1	Apollo County Game Board

Equipment and Supplies for Laboratory Activity

Supplies (Per class)

1	Water plant site marker
1	Sewage plant site marker

Overview (5)

1. In the text you read about utilities and transportation services that are needed for primary construction.
2. I will explain how utility services such as water and sewer, function.
3. During the laboratory activity you will develop and locate a water treatment plant and sewage plant which will serve the Sonic Jet plant.

Lecture (15)

1. Primary construction cannot operate without transportation services such as roads, railroads, water transportation, air transportation, and pipelines. Utilities such as gas, electricity, water, sewer, and telephones are also required for primary construction. To provide these services, additional construction is required. Construction that provides a primary construction object with the services it needs is called *service* construction.
2. Nearly all primary construction requires sewer and water services. To provide this service many things must be built: sewage treatment plants, water treatment plants, sewage and water pipes, and water pressure tanks or towers.
3. Show Transparency 176-1, Water Supply Systems.
   a. Water is pumped from a source to a treatment plant where it is purified and then pumped to a high storage tank. This tank is needed to give the water enough pressure to flow throughout the system.
   b. Water flows from the storage branch pipes to individual homes and factories, etc.
   c. There it is used (sinks, toilets, industrial processes, etc.) and flows out of these buildings in small pipes—*by gravity.* These "branch" pipes connect with larger pipes which always flow downhill.
   d. These large pipes or mains connect into one pipe that enters a plant where the sewage water is treated to purify it. Eventually the purified water empties into the river.
4. A water storage tank must be high enough so that gravity will force the water to any place needing water. The sewage treatment plant must be at the lowest point in the area when a gravity flow system is used.

5. Read News Report 2 to the students.

News Report 2

THE APOLLO COUNTY HERALD DISPATCH

Sonic Jet Creates Utility Problem

Providing utilities for the Sonic Jet plant now being built near Ray River has become a problem for Harry Sliderule, Apollo County Engineer.

"Private utility companies have assured Sonic Jet that electric, gas, and telephone service will be available at the new plant when it opens," said Mr. Sliderule. He added, "However, the plant will still need treated water supply and sewage disposal facilities."

Sonic Jet officials estimate that their new plant will require 900 units of water. It will produce, they believe, 600 sewage units of water. Both the water needs and the waste production will be equal to that of 2,400 houses!

Sonic Jet has said that it will pay ½ the cost of construction of the new water and sewage facilities.

The water plant will be located as far upstream as possible in order to reduce the chance that the intake water will be polluted by future land development in the vicinity of the Sonic Jet plant.

The tract chosen for the water plant must have hard soils to support the weight of a heavy water tower. The ground slope must be either flat or slightly sloped for economic construction.

The sewage treatment plant will probably be built as far downstream as possible. "We don't want any riverside properties that might be developed near the Sonic Jet plant to be affected by accidental pollution of the river caused by the outlet from the sewage plant," said Mr. Sliderule.

The tract selected for the sewage plant must be on Ray River, into which the treated fluids will be piped. The plant will also have to be on low ground because sewage flows downhill.

According to Mr. Sliderule, the tract cannot have soft ground, as the equipment must be adequately supported. The ground should also be flat.

The County Engineer said that the pipes connecting the utility plants to the Sonic Jet factory will generally *follow state and other existing road routes.* This will make installation of the pipes easier and allow residents who live near the road to tie into the utility system.

The land owners in the vicinity of the new factory have hired a team of utility consultants who will aid Mr. Sliderule in determining the type and location of the utility facilities that should be constructed. Most of the landowners are in favor of the water and sewerage utilities because it will increase the value of their land.

"I am anxiously awaiting the report of the utility consultants hired by the local landowners," said Mr. Sliderule. The utility facilities must be built as soon as possible so the Sonic Jet plant can start production as soon as possible.

6. On the chalkboard write the News Report facts shown in Fig. 176-1.
7. Point out the river flow direction on the game board. Point out the general area of the "R" tracts *upstream.* Point out the general area of the "F" tracts *downstream.*
8. In which general area will the sewage plant be located? (In the "F" tract area—*downstream.*) In which general area will the water plant be located? (In the "R" area—*upstream.*)
9. Today, as utility consultants, you will select sites for the utility plants and then build the water and sewage plants.

Fig. 176-1. News Report Facts

Water		**Sewage**	
900 units		600 units	
Water Plant:	Upstream on river. Hard, flat, or sloped site.	Sewage Plant:	Downstream on river. Low ground. Firm or hard site.

Both plants on state route or on other existing road.

It will also be necessary for you to connect the various pipes from these plants to the Sonic Jet plant.

Laboratory Activity (25)

1. Open your Laboratory Manuals to Activity 92.
2. Show Transparency 176-2, Selecting the Sewage and Water Plant Sites, with overlay, Chart 92-1. The tract numbers in Chart 92-1 are potential sites for the water plant. They have satisfied all the requirements, which are: *upstream location on the river, hard soil, flat or sloped land,* and *location on a state route or on an existing road.*
   a. (Check off all these qualities under "Water Plant" on the chalkboard.) These tracts (S1, R6, R5) must now be checked to see if their ground is either flat or sloped and hard or firm. It is also necessary to determine which tract is farthest upstream. (Students can use their own map or the large 4′ x 4′ Apollo County Board Game to complete Table 92-1. Overlay should be flipped to show correct answers.)
   b. The site for the water plant will be on tract No. R5.
3. Attach the water plant marker on tract No. R5 on the gameboard. Students should label tract R5 as the water plant on their map.
4. Now the tract for the sewage plant must be established. (Show Transparency 176-2, with overlay, Chart 92-2.) The tract numbers in Chart 92-2 are *potential sewage plant sites.* These tracts must satisfy all of the following requirements: *downstream on river,* either *flat or sloped soil,* either *hard or firm soil* and *location on a state route or other existing road.* Complete Chart 92-2 and check your findings. (Flip overlay to show correct answers.)
5. Report your answers. (F4 is the site of the sewage plant. Attach the sewage plant marker on tract No. F4 on the gameboard. Students should record tract F4 as the sewage plant site on their maps.)
6. The cost of the land tracts we have selected for the water and sewage plants must now be determined. (Show Transparency 176-3, Estimating the Land Price of Utility Plant Tracts, with overlay, Chart 92-3.) Enter tract No. *R5* under "water plant" and tract No. *F4* under "sewage plant" in Chart 92-3. Acting as community managers, *half of the class will find the land cost of the water plant tract,* and the other *half will find the land cost of the sewage plant tract.*
7. Report the price of the water and sewage plant tracts. (Flip over the overlay.) Everyone record this price in Chart 92-3. (Water plant tract price is $30,000.) Report the price of the sewage plant tract. Everyone record this price in Chart 92-3. (Sewage plant tract price is $30,000.)
8. To find the Total Utility Plant Development Cost in Chart 92-5, you must first compute the Total Water Plant Cost in Chart 92-4. (Show Transparency 176-4, Utility Plant Costs, Chart 92-4.) Find the *smallest* Water Plant Capacity, in Chart 92-4, that can meet the water units needed (1,000). Enter this capacity and its cost ($108,000) in Chart 92-5. (Show Transparency 176-4, Chart 92-5. Flip first overlay.) Next, from Chart 92-3 enter the Land Price ($30,000) in Chart 92-5. Find the total Water Plant Cost ($138,000).
9. Fill in the blanks for "Sewage Plant" in Chart 92-5 and check your answers with your teammates. Raise your hand when you have the answers.
10. (Select someone to report.) (Show Transparency 176-4, Chart 92-5. Flip second overlay.) Answers should be: Capacity—1,000 units; Cost of Plant—$110,000; Land Price of Tract—$30,000; Total Sewage Plant Cost—$140,000.
11. Add the "Total Cost of Sewage Plant" to the "Total Cost of Water Plant" to find the "Total Cost of Utility Plants." ($278,000) (Show Transparency 176-4, Chart 92-5. Flip third overlay.)
12. You will also need water and sewer pipes to connect Sonic Jet to the utility plants. The larger the pipe diameter, the more expensive it is, so you should not select pipe larger than the diameter needed. The correct diameter is determined by the number of water or sewage units required. (Show Transparency 176-5, Pipe Capacity and Util-

ity Costs, and point out the price for 12″ pipe which will be required for 1,000 water units per tract.)

13. The 12″ diameter water pipe must be installed along the road from Tract Number R5 to the Sonic Jet plant. To determine the cost for laying 12″ pipe this distance, we will do the following:
    a. Count the number of tracts which will be crossed by the pipelines. Use the large Apollo County Map to count tracts. Remember to follow the road when counting the tracts. (Answer: 10 tracts. Write answers on chalkboard; do not erase.)
    b. Multiply the cost per tract by the number of tracts crossed. (Answer: $4,000 × 10 = *$40,000*, cost of utility pipe for *water plant.*)
14. Pipe costs for the sewage plant must also be developed in the same manner. (Refer again to Transparency 176-5, Chart 92-6.) 600 sewage units are needed, so 24″ pipe at $10,000 per tract must be used. (Write answer on chalkboard. Answer: $10,000/tract. Point out the number of tracts the pipeline will cross from F8 to the Sonic Jet plant. Write answer on chalkboard; do not erase. Answer: 11 tracts. $10,000/tract × 11 tracts crossed = *$110,000*, cost of utility pipe for *sewage plant.*)
15. To determine the *total* utility pipe cost, add the two amounts underlined. (Answer: $110,000 + $40,000 = $150,000. Write on chalkboard.)
16. Each student can now fill in Chart 92-7 to find the entire utility plant cost and the amount which must be paid by the Apollo County Community. (Have students complete Chart 92-7. Then show Transparency 176-5, Chart 92-7.)
17. The community cost for the utilities will be paid in part by the developers, and each developer will pay 1% (1/100) of the community costs. Complete Chart 92-8. Report your answers. (Developer's share should be $2,140.)
18. On Chart 97-3, the Developer's Cost Balance Sheet in the back of your Laboratory Manual, enter $2,000 ($2,140 rounded to even thousands), next to Activity 92.
19. Clean area and store Laboratory Manuals.

Homework

Reading 93

ASSIGNMENT 177, UNIT 93

Housing People

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given information related to housing people:
   a. Tell how you can determine if you live in low density, medium density, or high density housing.
   b. Explain why high density housing is usually found close to places of major employment.

Laboratory Activity

2. Given a map of Sonic City:
   a. Determine the type and number of houses for 3,320 people.
   b. Determine the profit or loss of a land developer.

Time Schedule

5 Overview
10 Lecture
30 Laboratory Activity

Equipment and Supplies for Lecture

Equipment

1 overhead projector/screen

Supplies

Transparency 177-1, 177-2, 177-3

Equipment and Supplies for Laboratory Activity

Supplies (Each class)

12 SF (3) Housing Site Markers
20 SF (5) Housing Site Markers
28 SF (7) Housing Site Markers
4 "Unsold" Site Markers
1 Apollo Gameboard

Overview (5)

1. Your textbook dealt with the topic of housing people. It pointed out how primary and secondary workers create a demand for houses and community development.
2. You also learned that family income plays an important part in determining housing density.
3. Today we will discuss housing density, and during our laboratory activity you will play the role of a land developer.

Lecture (10)

1. Can anyone define and give examples of the housing density concept? (Housing density is a measure of the number of housing units per unit area of ground. The unit of ground area is the acre, (43,560 sq. ft., about the size of a football field.) It has been stated in the text that one to three single-family detached houses per acre are considered low density, four and five houses per acre are considered medium density and six and seven houses per acre are considered high density for single-family housing.)
2. Can anyone state what relationship housing densities have for family incomes? (High income families usually are able to pay the high prices of low density single-family dwellings, middle income levels buy medium density single-family housing and low income people usually live in high density single-family housing.)

Laboratory Activity (30)

1. To make the community planning game more interesting, the class will be divided into four teams of developers, each with 10 million dollars of capital. You will compete to see who can make the most profit from community construction. (*Select four team captains,* preferably those who have good background in mathematics, and are recognized as student leaders. Separate the class into four groups, each with a team captain.)
2. Assign a township name; Ponderosa, Marion, Ford, and Salem, to each team.
3. Open your Laboratory Manuals to Activity 93. (Have the students write the name of their team and captains in the space provided in the Laboratory Manual.)

4. (Read News Report 3 to the class.)

News Report 3

THE SONIC CITY JOURNAL

Expert Comments on New Jobs at Sonic Jet

Mr. E. M. Ployment, a professor of labor economics at State University was interviewed today regarding the 1,328 new workers who will be employed at the recently completed Sonic Jet plant. He stated that the employment outlook was especially good since 1,328 primary workers hired by Sonic Jet would need an additional 1,992 workers to provide them with community services. Mr. Ployment was quick to mention, however, that the total number of workers (3,320) and their families would require housing in the very near future. When asked to comment on housing development Mr. Ployment estimated that 360 workers would each earn $15,000 per year and require low density housing; 1,000 workers would each earn $10,000 per year and require medium density housing; and 1,960 would earn $5,000 per year and require high density housing.

Four teams of developers have already shown interest in building houses in the vicinity of the Sonic Jet plant. They plan to develop enough 10-acre tracts to house the estimated 3,320 workers in Apollo County.

5. Show Transparency 177-1, Estimating the Housing Market, without overlay, Chart 93-1. Review the figures in the news article by pointing out the "Worker Income Level," "Housing Type Required," and "No. of Housing Units Required."
6. SF (3) is low density housing and indicates that 3 single-family houses will be constructed on one acre of ground. Since the tracts in Apollo County are divided into 10-acre plots, a total of 30 houses can be constructed on one tract. (Flip first overlay on transparency.) Since 360 housing units are needed, 12 tracts of land will need to be selected. (360 ÷ 30 = 12) Have students record this information in Chart 93-1.
7. You should now be able to compute the number of housing units per tract and the number of tracts required for SF (5) and SF (7) housing in Chart 93-1. (Call for answers and flip second overlay.)
8. Since 12 tracts are required for SF (3) low density housing, each team should select *3* tracts for this type of housing. Medium density housing requires 20, SF (5) tracts; therefore, each team should select *5* tracts for this type of housing. High density housing requires 28, SF (7); therefore, each team should select *7* tracts for this type of housing.
9. *Before* each team selects the tracts in *its township,* they must know the requirements for SF (3), SF (5), and SF (7) house types. This information is given in Chart 93-2. (Show Transparency 177-2, Tract Study Assignments.) Fill in Chart 93-2 with tract numbers of tracts from *your township* which satisfy the land requirements listed. Each team has 10 minutes to select its tracts. To save time two memmembers of the team can select the tracts for SF (3) housing, two others the SF (5) housing and so on. As you select the tracts, mark them on the map in your Laboratory Manual. When finished, team captains can paste the housing markers on large Apollo County gameboard.
10. Each team will now sell all of its tracts except for *one tract farthest* from the Sonic Jet plant. (Students should mark the unsold tract in their Laboratory Manual while the team captain adheres the "unsold" marker on the gameboard.)
11. (Illustrate Transparency 177-3, Profit or Loss from Sale of Housing Units, Chart 93-3.) Using Chart 93-3, each captain, with the help of his team should record *all* of the tract numbers developed in his township. After completing this, make a check mark in Chart 93-3 to indicate the *unsold* tract. Complete the last column by recording the sales income from *only* the tracts sold. Raise your hand when you have completed this. Add the amounts in the last column to determine your total sales income and record in Chart 93-3. To find your profit you must subtract the "total development cost" from your "total sales income." Record profit or loss in Chart 93-3. (Captains can com-

pare profit with other teams to determine winner.)

12. Each student should record profit or loss on Chart 93-3, the Developer's Cost Balance Sheet in the back of his Laboratory Manual.

Homework

Reading 94

ASSIGNMENT 178, UNIT 94

Planning Business Facilities

Objectives

As a result of their learning experiences the students should be able to do the following:

Text

1. Given situations related to planning business facilities:
    a. Identify the central business area in your community and explain why new shopping centers have or have not been developed.
    b. Tell how a high-speed mass transportation system would affect the central business district of a large city and state, whether or not you think central businessmen would support building one.

Laboratory Activity

2. Given the Apollo County map and charts, select the site and figure the cost of developing a local shopping center and central business districts in the community.

Time Schedule

5	Overview
10	Lecture
30	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Class)

1	sponge and dish

Supplies (Class)

1	Unsold marker
3	Central business district markers
4	Shopping center markers
1	Apollo County Map
1	Spinner

Overview (5)

1. Your text reading discussed shopping centers which serve the needs of small "trade areas" or neighborhoods in a community. It also discussed central business or "downtown" areas that serve the needs of an entire community.
2. I will tell you about some of the factors which affect the development of business and shopping areas.
3. In the laboratory activity, you will select a site and determine the cost for developing a local shopping center and central business district in your township.

Lecture (10)

1. Shopping facilities meet local needs by providing goods and services to the people.
2. Shopping can be provided to people either by "strip" development or by the construction of local shopping centers. (Describe the qualities of both types of

development and (if possible) refer to examples in the student's own town.)

3. The demand for and size of a local shopping center depends on the number of housing units in the community. This, in turn, depends on the number of workers and their families, which depends on employment at primary construction objects or service employment created by them.
4. Each local shopping center needs at least 1,000 housing units to support it adequately.
5. Local shopping facilities must be near major streets, close to utilities, and near to the neighborhood to be served.
6. In addition to local shopping centers, central business districts need to be developed near the center or hub of the community.
7. Central business construction must be located at the intersection of the most important streets. It also requires flat or sloped land (*not* steep), firm or hard soil, utilities and transportation facilities. Read News Report 4.

News Report 4

THE SONIC CITY JOURNAL
(Editorial Page)

Not Even a Loaf of Bread

The great growth of population in Sonic City has not been matched by the development of shopping areas. No shopping centers have been built, and the shopping trip to Turner Junction each week has almost become a habit for Sonic City residents.

Rapid growth causes problems, but we think it is about time that Sonic City, the largest town in Apollo County, had shopping centers of its own! There are over 15,000 people living in Sonic City, but they haven't a single store!

It has been decided that attractive local shopping centers and central business districts are to be built by four teams of developers. A study by the Regional Planning Commission revealed that there is adequate support for both shopping centers and central business districts in Sonic City. In the newly published report it was stated that Sonic City now has enough housing units to support one 10-acre shopping center per township and three 10-acre central business districts for the entire city.

Each of the four developers has stated that he will build a tract of central business in Sonic City. Commenting on this report, Mayor Grater said, "If the market study by the Regional Planning Commission is accurate, one of the developers will lose a great deal of money. Only three tracts can be supported, the fourth won't be sold."

Laboratory Activity (30)

1. Instruct students to open their Laboratory Manuals to Activity 94.
2. Each team is to select four tracts in its township that would be a good site for the construction of a local shopping center. When selecting the tracts be sure to consider the information covered in the textbook regarding an ideal site for a shopping center. It is also permissible to select a tract developed for residential housing if a satisfactory undeveloped tract cannot be found. If this is the case, the existing housing development must be demolished in order to clear the site for the local shopping center.
3. Enter the four tracts in Chart 94-1 and then complete the table by answering "yes" or "no" to each question. See Chart 94-1.
4. When you have found a tract that meets all of the conditions of Chart 94-1, each team member completes Chart 94-2 for this tract. If more than one tract meets all of the conditions, the team should vote for the *one* it wishes to develop. Record "Shopping Center" on your map in the Laboratory Manual when the tract has been selected.
5. As developers of central businesses, each team is to construct one tract of Central Business in its township. This construction may have to take place on tracts already developed for another use, requiring the purchasing and demolition of the existing structures.
6. Each team is to select four tracts in its township that would be a good site for a central business district. Here again, consider the important location factors for a central business site.
7. Enter the four tracts in Chart 94-3 and then complete the table by answering "yes" or "no" to each question. See Chart 94-3.

8. When you have found a tract that meets all of the conditions of each team member complete Chart 94-4 for this tract. If more than one tract meets all of the conditions, the team should vote for the tract it wishes to develop. Record "Central Business" on the map in your Laboratory Manual.
9. Only three tracts will be sold as the fourth lacks housing unit support. We will spin the "spinner" *once* to determine which team will not sell its tract.
10. Spin the spinner, announce the "loser," and place an unsold marker on the Apollo County Map.
11. All students are to enter in Chart 94-5 both tracts of land developed. The teacher should have each captain call off the tracts. (At this time shopping center and central business district markers should be placed in their proper location on the large Apollo County Map.) The team that did not sell its central business tract failed to get back its money for the development of the tract. Therefore it will be necessary to subtract this *loss* from the *profit* which was received from the development of the local shopping center.
12. Enter total profit or loss from Chart 94-5 in Chart 97-3, the Developer's Cost and Balance Sheet in the back of the Laboratory Manual.

Homework

Reading 95

ASSIGNMENT 179, UNIT 95A

Planning Schools and Recreational Facilities

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to planning schools and recreational facilities:
   a. Estimate the number of housing units served by your school.
   b. Explain how you could determine whether or not your community has adequate recreational facilities.

Laboratory Activity

2. Given the Apollo County map and charts from Activity 95:
   a. Select the appropriate sites for school and park construction.
   b. Figure the costs of school and park construction.

Time Schedule

5	Overview
10	Lecture
30	Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment

1	Sponge and dish

Supplies

8	Elementary school site markers
4	Junior-senior high school site markers
4	Neighborhood park site markers
4	Community park site markers
1	Gameboard

Overview (5)

1. Your text discussed how schools and recreational facilities are planned for a community.
2. I will tell you how many housing units are required to support different kinds of schools.
3. We will discuss how recreational facil-

ities should be planned for a community.
4. During the laboratory period your team will select the sites and compute the construction costs for schools and recreational facilities.

Lecture (10)

1. Read News Report 5 to class.

News Report 5

THE SONIC CITY JOURNAL
(Editorial Page)

"Sonic City" or "Hicktown?"

Sonic City should be called "Hicktown." Since the Sonic Jet plant opened two years ago, the area has grown rapidly in population. Many more SF (3), SF (5), and SF (7), houses have been constructed, in addition to the initial houses constructed by our four township developers. Schools for our children have not been constructed and the present cost for educating and transporting our children to Turner Junction has skyrocketed. The population explosion in Sonic City has also put a strain on the limited recreational facilities available in our community. Actually there have been no recreational facilities constructed as such. It is time for the residents of Sonic City to realize that schools and recreational facilities are desperately needed if the community is to prosper.

With this in mind we urge you to support the four community developers who are presently developing a plan to provide adequate schools and recreational facilities for Sonic City.

2. Prior to developing schools and recreational facilities, I will review some important facts which will affect your planning.
3. Elementary schools generally require a *minimum* of 550 housing units for support. These schools should be located close to the houses they serve and away from areas of heavy traffic. Junior-senior high schools can be located slightly farther from the housing units they serve but should be located near a major road to facilitate transportation. Generally it takes about 3,000 housing units to support a junior-senior high school.
4. The four township developers have learned from the township council that there are approximately 3,300 housing units existing in *each* township.

Laboratory Activity (30)

1. Open your Laboratory Manual to Activity 95 and examine Chart 95A-1.
2. Based on the number of housing units in your township (from Chart 93-1), determine the *number* of schools (elementary and junior-senior high) necessary and then the number of tracts needed to provide adequate land for construction. For example, if your township has 700 housing units, one elementary school could be supported, and one tract of land would be required for the site. Proceed to determine the required number of schools and tracts for your township. (Answer: two elementary schools which require one tract *each* and one junior-senior high school which requires two tracts.)
3. Select the tracts for both schools and record them in Chart 95A-2. If the tract satisfies all requirements in Chart 95A-2, it may be used as a site. Record the sites selected at the bottom of Chart 95A-2. It may be necessary to select a site which has already been developed.
4. Fill out Chart 95A-3 to determine the *total cost* of school construction. This is found by determining the total elementary school costs and adding them to the total junior-senior high school cost.
5. Enter the total costs in Chart 97-3, the "Developers Cost and Balance Sheet" in the back of your Laboratory Manual.
6. Record the sites selected for schools on your map in the back of the Laboratory Manual. (Team captains should paste site markers on large 4′ x 4′ Apollo County Map.)
7. Recreational facilities will now be developed. You should recall that playgrounds, playfields, neighborhood parks and community parks are the four types of recreational facilities. You will not have to develop any playgrounds or playfields since these were constructed with the schools. Each team will develop one nieghborhood park and one community park for its township. The neighborhood park will require one tract of land while the larger community park will require two tracts.

Any type of land may be selected for the parks (flat, sloped, soft or hard); however, the *neighborhood park* should be *near high density* housing and the *community park* should be *near a major road*. Ideally the land sites selected for both parks should be near utilities and be undeveloped.

8. Select *one site* for the neighborhood park and two *adjoining sites* for the *community park* and record these tracts in "Tracts Selected," Chart 95A-4.
9. Complete Chart 95A-4 to determine the land costs and total development cost for the parks.
10. Enter the total cost for both parks in Chart 97-3, the "Developer's Cost and Balance Sheet."
11. Record the tracts selected in your Laboratory Manuals while the team captains place the park site markers on the gameboard.
12. Put away your Laboratory Manuals.

Homework

None

ASSIGNMENT 180, UNIT 95B

Expanding Community Services

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the Apollo County map and the charts in Activity 95B:
   a. Select the sites and compute the cost for high density housing in a township.
   b. Figure the profit or loss for the construction of an interchange.

Time Schedule

5	Overview
15	Lecture
25	Laboratory Activity

Equipment and Supplies for Lecture and Laboratory Activity

Equipment

1	sponge and dish

Supplies

	Site Markers:
2	Sold
15	Multi (15)
10	Multi (35)
6	High Rise (60)
1	Interchange
1	Spinner
1	Gameboard map

Overview (5)

1. During the last week, we discussed the major aspects of community development such as planning for housing, utilities, businesses, schools, and recreation areas.
2. Today I will tell you about expanding community services through the constructing of high rise apartments, multifamily dwellings and a highway interchange.
3. In your laboratory activity, you will select the sites and compute the cost of high density housing which is needed in your township. You will also compute the cost for the construction of an interchange.

Lecture (15)

1. "High density" housing means that many housing units are constructed on a small

area of ground. The "density" is high because there are many housing units on an acre of ground.

2. High density housing is constructed when two conditions exist: (a) a great demand for housing, and (b) available land is expensive. The price of undeveloped land may be low. In this case, low density housing can be built at a profit. However, the cost of buying developed land and clearing it for new housing will usually be great. Under these circumstances a developer must build high density housing to make a profit.
3. Two general types of high density housing are often built: (a) "multifamily" housing (attached housing units less than four stories with stairways), and (b) "high rise" housing (attached housing units of four or more stories served by elevators and stairs).
4. "High rise" housing is much more expensive to construct than "multifamily" housing. "High rise" housing will only be built where the land price is so high that multifamily housing for middle or low income families cannot be profitably built and where there is a great demand for housing for high income families.
5. Read News Report 6.

News Report 6

THE SONIC CITY JOURNAL

Sonic Jet Announces New Employment Increase

The Sonic Jet Company today announced that recently signed research contracts will cause the addition of 2,500 new employees at the Sonic City plant during the next year.

The boom in employment at Sonic City will probably change the housing construction market.

Pressure will be great for multifamily and high rise housing units because of the great increase in housing need and land price that has come about during the past few years.

New single-family housing units probably will not be built, but existing housing units will be sold. The remainder of the housing demand will be met by construction of multihousing units and high rise apartments.

The construction of high density housing units to meet the housing needs of increased employment will *create* needs for additional street, water, and sewer *services* that the present facilities cannot fulfill. This will make more community-facility construction *necessary*.

Laboratory Activity (25)

Problem 1 Expanding Housing

1. Open your Laboratory Manuals to Activity 95B and take out your maps. Because of the need for additional houses *two* of the original four unsold housing tracts will now be sold. (Spin the spinner twice to determine which two townships will sell their unsold housing tract.) Team captains can adhere "sold" markers to the gameboard. Profit from the sale should be recorded in Chart 97-3, the Developer's Cost and Balance Sheet at the back of the Laboratory Manual.
2. Based on a report from the Regional Planning Commission, there will be a need in *each township* for the following housing units: two high rise (60) apartment buildings, three multifamily (35) apartment buildings, and four multifamily (15) apartment buildings. As high density housing developers, you are to select sites for these developments in *your township*. (Write 2-HR (60), 3-MF (35), and 4-MF (15) on the chalkboard.)
3. Look at your map and propose sites for these developments to your team captain. Enter them in Chart 95B-1. Remember, all tracts to land *must* meet the site needs listed in Chart 95B-1.
4. Enter these developed tracts of land in Chart 95B-2.
5. The population did not increase as expected, therefore not all land will be sold. (Using the spinner, identify two townships that will lose an HR (60); two townships that will lose a MF (35); and one township that will lose a MF (15). No township should be allowed to lose more than one of each type of high-density housing tract.) Check the unsold tracts in Chart 95B-2.
6. Enter the cost of any unsold tracts in the last column of Chart 95B-2. This cost is figured by adding the land cost and the construction cost.
7. Subtract the total cost of all unsold

tracts from $13,950.00 to get the "Total Developer's Profit" (or loss).

8. Enter the profit or loss in your "Developer's Cost and Balance Sheet" in the back of your Laboratory Manual.
9. On your maps, mark "Multi" in each tract developed for multiple housing in *all* townships. Mark "HR" in all tracts developed for high-rise housing. Mark *unsold* "Multi" or "HR" tracts on all unsold tracts.
10. The teacher or team captains should place the HR (60), MF (35), and MF (15) site markers on the gameboard in their proper location for each township.

Problem 2 Expanding Streets

1. The increase in housing units has caused great traffic problems at the intersection of State Route #1 and State Route #2. The Regional Planning Commission indicated that more than 2,400 cars an hour must move through this intersection which is controlled by a light. Considering the large number of cars and the daily traffic snarls at this intersection, it was suggested that the overpass kind of intersection, called an interchange, be constructed. With an interchange, one street is carried over the other on a bridge. The cars using the two streets do not meet each other so traffic flow is not interrupted or stopped. The final recommendation made by the Regional Planning Commission was that construction of the interchange begin immediately at the intersection regardless of cost.
2. In order to develop the interchange at the intersection, it will be necessary to clear and demolish any construction on Tracts X4, E5, H1, and S2. The state has agreed to reimburse the developers for the land according to the rates in Chart 95B-3.
3. Enter any reimbursement you would receive in Chart 95B-4. Compute the profit or loss and enter it in Chart 97-3, the "Developer's Cost and Balance Sheet" in the back of the Laboratory Manual.
4. The teacher or team captains can place the interchange site marker in the proper location on the Apollo County map while the students mark their own maps.
5. If any time remains, you can discuss any other expanding which might be necessary such as streets, utilities, schools, etc.

Homework

Reading 96

ASSIGNMENT 181, UNIT 96

The Economics of Community Development

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to the economics of community development:
   a. Name what area or areas in your city or community are deteriorating.
   b. Describe any plans you know of to improve your community by rebuilding parts of it.

Laboratory Activity

2. Given the Apollo County map and the charts in Activity 96:
   a. Figure the loss of money due to reduced employment at Sonic Jet.
   b. Figure the loss of money due to environmental value in Sonic City.
   c. Figure the developer's total loss due to deterioration in Sonic City.
   d. Identify two urban renewal projects to be constructed in Apollo County.

Time Schedule

5 Overview
10 Lecture
30 Laboratory Activity

Equipment and Supplies for Lecture and Laboratory Activity

Equipment

1	sponge and dish

Supplies

12	Urban Renewal Site markers
1	Apollo Gameboard

Overview (5)

1. Your text discussed the factors which lead to the deterioration of a community and the effect it has on its citizens.
2. I will tell you more about deterioration and how it has affected Sonic City.
3. In the laboratory activity you will compute the cost of deterioration in Sonic City and also list some possible projects for urban renewal.

Lecture (10)

1. Constructed objects in poor physical condition, those that are "deteriorated," are not as valuable as objects that are in good condition; therefore, deterioration of structures results in economic loss to their owners.
2. Most deterioration in communities is not caused by owners who are unwilling to make repairs, but by a community condition that makes repair uneconomical!
3. The three basic community conditions that cause deterioration are (a) reduced employment in primary construction which causes a reduced market for quality construction, (b) loss of locational value, and (c) loss of environmental value.
4. Whenever any *one* of these conditions exists in a community for a long period of time, the deterioration of structures will usually occur.
5. Read News Report 7 to the students.

News Report 7
THE SONIC CITY JOURNAL
Citizen Committee Reports
Deterioration in Sonic City

A report published by the Citizen's Council for Improvement of Sonic City (CCISC) reveals that the Sonic City area is experiencing widespread economic depression.

The report blames the city's depressed condition on Sonic Jet's decision to move a major part of its operation. Since this was done five years ago, there have been 20% fewer jobs in Sonic City.

A result of this job loss, the report continues, was the movement of 2,000 families out of the city. The 2,000 housing units left vacant have caused an excess of available housing and a great drop in housing values.

Aggravating the situation is the fact that repairs are not being made on both unoccupied and occupied dwellings, as land values may drop more. Local shopping and central business areas are also suffering from lack of repairs because they have lost 20% of their business.

Single-family housing far from the Sonic Jet plant has lost its locational value because so many units close to the Sonic Jet plant are vacant. Multiunits that are not on main streets also suffer from the same problem.

Local shopping centers that are not on main streets or roads have also dropped in value as they lack the traffic volume needed for their support.

The CCISC report also cites other causes, other than Sonic Jet's actions, to explain the city's depressed condition.

It observes that many tracts of single family, multifamily high rise housing, as well as local shopping centers, have lost great value because they have been built where noise, air pollution, or child safety problems exist.

Railroad noise has affected tracts near the railroad. The ear-piercing sound of jet engines being tested has also affected the tracts near the Sonic Jet plant.

The report also notes that the smell of the sewage plant has reduced the value of residences and shopping locations in areas near the plant. It also states that many single family tracts near main streets have suffered because of the noise of traffic and the child safety problem.

Members of the committee suggested that the four township developers take immediate steps to help eliminate the deterioration existing in Sonic City. They urged the developers to examine community deterioration in terms of loss to the community and themselves. The final recommendation made was that the developers begin immediate plans for urban renewal in Sonic City.

Laboratory Activity (30)

1. Open your Laboratory Manuals to Activity 96. Each team will estimate the economic loss to the community resulting from a cause of community deterioration. The *Ponderosa* team and the *Marion* team will study "Reduced Employment" by completing Problem 1. The *Salem* team and the *Ford* team will study "Loss of Environmental Value" by completing Problem 2. Each team is to complete its section for the *entire community*, not just its township!
2. Read the problem for your team's section and complete the *entire* section. Team Captains, you have just 10 minutes to complete this. Team Captains, raise your hands when finished.
3. Circulate around the room while the students are doing this, answering questions as they arise.
4. Team Captains, report and compare your findings in the order in which they appear in Chart 96-3. Students record these results in Chart 96-3 as they are reported.
5. Students now find the "Total Community Deterioration Loss" in Chart 96-3. (Select students to give their answer. Comment on its magnitude!)
6. Team Captains with the help of team members should now determine the "Developer's Deterioration Loss" for *their* township. Insert the name of your township in Chart 96-4. Fill out Chart 96-4 and enter this amount as loss in Chart 97-3, your teams Cost and Balance Sheet at the back of the Laboratory Manuals. (Remind students to work only within their own township.) Raise your hands when finished.
7. Each township must make an effort to renew the sections of Sonic City that have deteriorated the most. The low income, high density SF (7) tracts are becoming slums, and action must be taken immediately.
8. Each team is to *redevelop three tracts* of SF (7) housing. You are to select some type of major construction project or projects that could be built on these three tracts to help renew Sonic City.
9. Federal aids for *urban renewal* may be obtained to help pay the cost if the project (or projects) are worthwhile. See Chart 96-7 for possible projects.
10. After discussion with your team, list the three tracts of SF (7) in Chart 96-6 which are to be developed.
11. Complete Chart 96-6 by identifying what the urban renewal project or projects will be and list reasons why it will help renew Sonic City.
12. Team Captains can locate the blank site markers on the gameboard and write in the urban renewal projects.
13. Each team should enter the profit from Chart 96-6 for their projects in Chart 97-3, the Developer's Cost and Balance Sheet in the back of the Laboratory Manual. (If students select projects other than those in Chart 96-5, the teacher should estimate the number of tracts required and the expected profit.)

Homework

Reading 97

Managing Community Development

Objectives

As a result of their learning experiences, the students should be able to do the following:

Text

1. Given situations related to managing community development:
    a. Describe what can be done in your community to control air or water pollution.
    b. Interview your parents for ways to make your home, your community, and your region of the country a better place in which to live and explain how well-planned construction might assist in reaching such a goal.

Laboratory Activity

2. Given charts from Activity 97, figure profit or loss from community planning practices.

Time Schedule

5 Overview
10 Lecture
20 Discussion
10 Laboratory Activity

Overview (5)

1. Your text discussed community planning. It identified some of the people who provide the leadership for planning and what some of their responsibilities are.
2. I will explain why it is necessary to have good leadership for community planning.
3. Today during your laboratory activity, you will total the Developer's Cost and Balance Sheet to determine the winning team.

Lecture (10)

1. City planners guide the development of communities. They are usually professionally trained men and women who have completed at least six years of college and hold master's degrees in city planning. There are over 6,000 professional city planners in the United States working with citizen members of planning boards or commissions to guide community development.
2. One of the many things a city planner does is inventory the existing city, keeping a complete description of the city as it is. In doing this, he produces land-use maps. The Land-Use Map shows the present use of each tract of ground in the city and each building.
3. This is just one record the city planner keeps. He also records building conditions, population location and characteristics, street traffic, slope soil qualities, etc. In short, he keeps a complete description of the community.
4. He uses this data to *project* the future problems of the city and its future growth. Together with the Planning Board, he proposes goals and objectives for the city of the future, compares these with the present and projected conditions of the city, and proposes a *General Plan* to guide future growth.
5. He prepares a *Capital Improvements Program* listing (a) each public facility that will be needed in the community, (b) the year in which it will be needed, (c) the estimated cost of the facility, and (d) the source of the funds needed for its construction.
6. The city planner and the planning board prepare laws and ordinances to control building and development.
7. While the city planner guides the development of a community, regional planners guide the development of many communities within its region.

Discussion (20)

Community Planning Factors

1. Did a community develop around the Sonic Jet plant site? (Yes.)
2. Why? (Because it is primary construction—the first construction project in an area, creating employment.)
3. What kind of a demand caused the construction of this primary construction? (Demand for economical location for manufacturing.)
4. What three *general* construction factors had to be met before construction of the Sonic Jet plant could begin? (Demand, utility, and site.)

Planning Community Services

1. What created the *need* (demand) for construction of the sewage plant, water plant and utility pipes? (Construction of the Sonic Jet plant, the primary construction project.)
2. Was anything else constructed in the area that the plant *needs* for its operations? (Yes, the roads and the railroads.)
3. Might these things be considered "service" construction. (Yes, as they provide services without which the primary construction project could not operate.)
4. When a river is used as a source for drinking water, why is the water treatment plant located upstream? (So that the water is not polluted before it enters the system.)
5. Is utility construction expensive? (Yes! The total cost—community's share + Sonic Jet's share—came to *$428,000!*)

Housing People

1. Most workers and their families prefer to live in the community where the worker is employed.
2. Land that is plentiful and purchased at low cost is developed into low density housing. (SF3, SF5, SF7)
3. After land in a community becomes scarce for residential building purposes, its cost is higher also. This brings about higher density housing. (MF (15), MF (35), HR(60).)

Planning Business Facilities

1. Why were there so few potential sites for central business construction? (They need locations at intersections of the most important streets in the community.)
2. Is it true that the location of central business construction, either "downtown" or in shopping centers, is determined when street and highway decisions are made? (Yes, as the location and types of streets constructed will create central business sites.)
3. Wouldn't it be better to keep sites that are good for local shopping development from being developed for housing, because then the developer's profit could be higher? (Certainly.)
4. Were the land costs for local shopping centers generally higher than when you were building housing? (Yes.)

Planning Schools and Recreational Facilities

1. Why are more elementary schools usually built in a community than junior-senior high schools? (They must be closer to the homes of small children. They cannot serve as many housing units efficiently.)
2. Could the construction of an elementary school raise the price the community will have to pay to build a future high school? (Yes. If it is close to an elementary school, the land price will have been raised by the existence of the elementary school.)
3. Why are *playfields* located on the junior-senior high school site? (Serves junior-senior high school age children and adults in the community, same walking limit as junior-senior high, can be used by school for its physical education program.)
4. Why can neighborhood parks be built on *any* slope, whereas *neighborhood* playgrounds can't be built economically on steep land? (Playgrounds need flat games areas, parks can have winding paths, etc., up steel hillsides.)

Expanding Community Services

1. What type of construction created most of the need to provide the larger facilities. (Housing.)
2. Since the people living in a community are so greatly affected by what we build as developers, do you think they have a lot of interest in what we build and where? (Yes.)

Economics of Community Development

1. What were the three basic causes of deterioration in Sonic City? (Reduced employment, loss of locational value, loss of environmental value.)
2. Did deterioration result in a *community* loss? (Yes)
3. Did deterioration result in loss to the developers? (Yes)

Managing Community Development

1. Why should a community manage its community development? (Discussion)
2. Why does a community need a city planner? Why doesn't the citizen plan-

ning board do the job itself? (Lacks the professional training.)

3. Does the city planner make laws that control community development? (No. He and the planning board *propose* them to the elected officials. These elected officials actually make the proposed controls into city law.)

Laboratory Activity (10)

Today students will determine the profit or loss to determine the winning team of developers.

1. Open your Laboratory Manuals to Activity 98.
2. Working with your team, total the Developer's Cost, Profit, and Loss, using Chart 97-3, the Balance Sheet in the back of your Laboratory Manual. Put the totals in Chart 97-1.
3. Complete Chart 97-1. Team Captain hold up your hand when you have your Team's Current Net Worth.
4. Enter the reported amounts in Chart 97-2. Identify the WINNING TEAM!

Homework

If optional Assignment 183 is used, have students bring their textbooks to class for collection. If the review is not used, have students study for the comprehensive achievement test and bring their textbooks to school for collection.

ASSIGNMENT 183, UNITS 91-97 (OPTIONAL)

Review 91–97

Objectives

As a result of their learning experiences, the students should be able to do the following:

Discussion

1. Given the summaries of Readings 1-97, ask and answer questions about various phases of community planning to include utilities services, high, medium and low density housing, central business, shopping centers, schools and recreational facilities as well as anything in the total course.

Time Schedule

45 Discussion or Laboratory Activity

Discussion or Laboratory Activity (45)

This review time can be used in various ways. Plan to do one of the following alternatives.

Alternatives

1. Students can play the "Big Builder" game to become more familiar with the concepts and processes of construction.
2. Pose the questions and situations at the end of each reading to stimulate thinking and discussion.
3. Have each "group" of students get together and list two or three words or concepts they would like to have explained or discussed. Discuss and clarify the concepts.
4. Ask a guest speaker, knowledgeable about city planning, to talk to the class. Schedule the speaker for the first class period, and tape record his talk so it can be played to your other classes.
5. Schedule a field trip to a city planning office.

Homework

None

ASSIGNMENT 184

Comprehensive Achievement Test

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given a Comprehensive Achievement Test, select the correct responses from a list of items to concepts presented in Readings 1-97.

Time Schedule

45 Laboratory Activity

Laboratory Activity (45)

1. Seat the students to best advantage for administering a test.
2. Distribute pencils, erasers, and eraser shields.
3. Distribute answer sheets and have students fill out needed information.
4. Pass out test booklets. "Keep closed until I say begin."
5. Read directions for filling in answers. Open test booklets and begin.
6. Allow 35 minutes for completion; then collect answer sheets, then test booklets.
7. Review the test with students to provide feedback.

Homework

None (end of course).

Answers for Comprehensive Exam

1. B	2. A	3. D	4. D	5. C	6. C	7. A	8. C	9. D
10. D	11. A	12. C	13. D	14. B	15. B	16. A	17. A	18. B
19. D	20. B	21. D	22. A	23. B	24. C	25. A	26. C	27. B
28. A	29. D	30. A	31. D	32. B	33. D	34. D	35. D	36. A
37. A	38. B	39. D	40. C	41. A	42. B	43. C	44. A	45. D
46. A	47. A	48. D	49. A	50. A				

ASSIGNMENT 185
(OPTIONAL)

Cleanup

Objectives

As a result of their learning experiences, the students should be able to do the following:

Laboratory Activity

1. Given the learning experiences in *The World of Construction,* reinforce the postprocessing concepts of maintaining by performing cleanup duties throughout the laboratory.

Time Schedule

45 Laboratory Activity

Equipment and Supplies for Laboratory Activity

Equipment (Per class)

3	buckets
3	scrapers

Supplies (Per class)

15	rags
1	can oil
6	sponges
1	box detergent

Laboratory Activity (45)

Maintaining a laboratory is a major part of postprocessing. Today we will clean the laboratory and ready it for next year.

1. Divide the class into groups of five students. Appoint one of the five as the manager, the other four as maintenance workers.

2. Assign each group a task. Examples: oil tools, stack materials, clean benches, clean floor areas, clean out lockers, store teaching aids, etc.

3. Proceed with cleanup.
4. Replace all materials and tools after 40 minutes.
5 Gather students together. Explain that you hope that they have found the study of the man-made world exciting and educational and just as important as the study of other school subjects. Explain that construction is one-half of the study of industrial technology, and you hope they will be excited about studying *The World of Manufacturing.*

Homework

None

Appendix A
Teaching Aids and Special Equipment

Transparencies

(Number corresponds to Assignment. Figures in parentheses indicate a series.)

5
7
11 (1, 2, 3)
13 (1, 2, 3)
14 (1, 2)
16
20 (1, 2, 3)
21 (1, 2)
22
23
26
31 (1, 2)
32 (1, 2, 3)
33
34
41
42
43
47 (1, 2, 3)
57 (1, 2, 3)
58 (1, 2)
59
60 (1, 2, 3)
61 (1-6)
62 (1, 2)
65 (1-4)
68 (1, 2, 3)
94
95
103
107
111 (1, 2, 3)
113 (1, 2)
122
123
143 (1, 2)
148 (1, 2, 3)
155 (1, 2, 3)
158
170
175 (1-5)
176 (1-5)
177 (1-3)

Filmstrips

(Assignment number, title, frames)

3	Student Activities, 71 frames
19	Steps in the Design Process, 23 frames
131	Servicing Activities, 31 frames
136	Construction in the Future, 18 frames
140	Planning your Dream House, 34 frames

Achievement Tests

(Assignment number, test numbers)

18.	1
40.	2
54.	3
67.	4
83.	5
105.	6
138.	7
154.	8
174.	9
184.	Comprehensive

Audio-Visual Equipment

(Equipment and Frequency)

Overhead projector/screen	43
Filmstrip projector/screen	5
16 mm. film projector/screen	optional on Assignments 5, 13, 132, 133, 134, 135
Tape recorder	9 optional on Assignments 5, 17, 39, 66, 82, 104, 137, 153, 173

Special Items (Minimum quantities)

(Per Teacher) Per 5 Classes	(25 Students) Per Class	Items	Assignment
5	5	Bow drill/hand block	4
1	1	Class Organization Chart	6
5	5	Site box	13, 15, 69
5	5	Level bar	13
5	5	Stadia rod	13
5	5	Level bar pin	13
5	5	Big Builder Game	8, 17, 39, 44, 45, 53, 66, 82, 104, 137, 153, 193
5	5	8 sht. of Working Drawings (All American Homes, Inc.)	29
1 set	1 set	Employment signs (8)	49
8	8	Men Wanted signs	49

(Per Teacher) Per 5 Classes	(25 Students) Per Class	Items	Assignment
8	8	Personnel Manager cards	49
24	24	Job Applicant cards	49
5	5	Model Obstacles kit	58
1	1	Jenny winch boom set (hardware and rigging)	78
1	1	Steel beam set (4 beams and 4 columns)	78
1	1	Bracket set for steel beams (4 sets of brackets)	78
15	15	Door and window cutting guides	158, 159, 160, 161
5	1	Apollo County Map	175
5	1	Sonic Jet site markers	175
5	1	Water Plant site markers	176
5	1	Sewer Plant site markers	176
60	12	SF 3 site markers	177
100	20	SF 5 site markers	177
140	28	SF 7 site markers	177
20	4	Unsold site markers	177
1	1	Game spinner	177
20	4	Local Shopping Center site markers	178
15	3	Central Business site markers	178
40	8	Elementary School site markers	179
20	4	Junior/Senior High School site markers	179
20	4	Neighborhood Park site markers	179
20	4	Community Park site markers	179
10	2	Sold markers	180
30	6	HR 60 site markers	180
50	10	Multi 35 site markers	180
75	15	Multi 15 site markers	180
5	1	Interchange site markers	180
60	12	Urban Renewal site markers	181

Demonstration Items

Per Teacher	Item	Assignment
1	Piled foundation (3 legged support)	15
6 or more	Copies of working agreement regulations between a construction union and a contractor's association	51
1	Transite (*or* several fire bricks)	98
1	2 any dia. cast iron soil pipe	99
1	1 any dia. clay soil pipe	99
1	2 any dia. plastic pipe	99
1	Local building inspection card (supplied locally)	102
1	10″ x 16½″ single strength glass	113
12	Glaziers points	113
1	½ lb. glazing compound (*or* ¾″ x ¾″ x 36″ quarter round molding)	113
2	Candles or paraffin wax	115
1	Heat lamp with clamp	115
2	Cardboard box approx. 1 cu. ft.	115

Per Teacher	Item	Assignment
Catalogs		
(Quantity, item and assignment used)		
3	Telephone Directories (supplied locally)	50
5	Builders' Supply Catalogs	36, 152
2	Sears Catalogs	152
2	Montgomery Ward Catalogs	152
Optional Film Topics		
(Topic and Assignment)		
	Construction technology or process	5
	Building Dams	132
	Bridge Building	133
	Road Building	134
	Building Skyscrapers	135

Note: Each teacher should look ahead and order films to show during the assignments listed above. The films are desirable but not essential.

Appendix B
List of Tools and Equipment for Students

(Based on 25 students per class)

Measuring and Layout Tools and Equipment

Quantity Per Teacher	Item	Assignment First Used
5	Watch with second hand (from student)	4
25	12″ rule	14
25	Architect's scale	149
5	Yardstick	139
10	12′ steel tape ½″ min. width	11
5	Compass and pencil	118
5	Wing dividers	94
10	Teaspoon	15
5	1 cup measure (plastic)	15
5	1 quart measure (plastic)	73

Sheet Metal Tools and Equipment

5	Hand seamer (*or* pan brake)	94
5	Tinner's setting hammer (*or* wooden mallet)	94
5	Center punch	94
5	1 slip roll (*or* 5 round stakes) (*or* 1 ft. of 2″ dia. pipe)	94
5	Cold chisel	72
5	5/16″ hand groover	94
5	Aviation snips (or equivalent)	94
5	Scratch awl (*or* scriber)	94
5	Bar fold (optional)	111

Plumbing Tools and Equipment

5	Pipe vise (*or* bench vise)	97
5	Pipe cutter	97
5	Pipe reamer	97
5	½″ die and stock	97
10	10″ pipe wrench	97
5	Tube cutter w/reamer	98
5	Hacksaw	72
5	Propane torch (small tip)	98
5	Striker for torch	98

Masonry Tools and Equipment

5	Mason's line	106
5	Plumb bob and line	80
5	24″ spirit level	65
10	Brick or mason's trowel 10½″ London pattern	76
5	Steel finishing trowel	73
5	Hand garden trowel	76
5	Brick chisel	114
5	Brick hammer	114
5	3/8″ jointing tool	76
1	Mortar box	73
1	Wheelbarrow	73
2	Mixing hoe	73
2	Shovel (round nose)	73

Quantity Per Teacher	Item	Assignment First Used
5	Mortar board 24″ x 24″	76
5	Hawk (plasterer's) 12″ x 12″	76
Carpentry Tools and Equipment		
5	¼″ hand drill (optional)	4
5	¼″ portable electrical drill	4
10	Crosscut saw	70
5	Ripsaw	70
5	Compass saw (*or* saber saw)	96
5	Coping saw	123
5	Miter box with back saw	113
5	Brace	96
5	Block plane	110
5	Nail sets	110
10	Framing squares	80
10	Try squares	26
5	Sliding T bevel	110
5	Chalkline	76
18	Claw hammers (13 or 16 oz.)	11
5	Wooden mallet (optional)	111
5	12″ ripping bar (*or* nail claw)	75
5	#4 auger bit	4
5	#8 auger bit	96
5	#16 auger bit	97
5	#12 auger bit	106
5	⅛″ twist drill	94
5	¼″ twist drill	4
5	⅝″ speed bit	72
5	¾″ speed bit	106
5	⅞″ speed bit	72
Electrical Tools and Equipment		
5	½″ conduit bender	101
5	Cable ripper (Romex)	101
5	Electricians knife (*or* wire strippers)	101
5	Fish tapes	101
5	American B and S wire gauge	102
1	25′ extension cord	115
1	Fuse assembly 50 Amp recommended	128
General Tools and Equipment		
5	4″ screwdriver (standard)	94
4	Adjustable wrench (*or* ⁹⁄₁₆″ socket wrench)	78
4	Spud wrench ¼″ to ½″ taper (*or* drift pin ¼″ to ½″ taper)	78
5	Needle nose pliers	127
5	6″ slip joint pliers	96
10	Side cutter pliers	26
5	Round file 102 and handle	97
5	Half round file and handle	123
5	Utility knife	107
25	Xacto® type model knife	157
5	Staple gun for ⁹⁄₁₆″ staples	107
5	Desk stapler	38
5	Mastic applicator	121

Quantity Per Teacher	Item	Assignment First Used
5	Putty knife	113
5	Tape knife	117
5	Paint scraper	75
5	C clamps	4
25	Scissors 3″	11
5	Dusting brush	121
25	Nail aprons	70
25	Safety glasses	4
1	Broom	119
1	Caulking gun and tube	124
1	Saw horse (*or* equivalent)	25
1	Rake	129
25	Artist's paint brushes	160
25	1½″ paint brush	124
15	3″ paint brush	125
5	Flat paint mixing paddles	121
5	Paint roller and pan	125
5	2-gallon bucket	16
5	Workbenches with vises	4
5	Barrel (*or* garbage cans)	119
1	Stepladder 5′ or 6′	124

Appendix C
List of Expendable Materials

(Quantities based on 25 students per class and 125 students per teacher)

Papers and Office Supplies

(Per Teacher) Per 5 Classes	(25 Students) Per Class	Item	Assignment First Used
1 ream	100 sheets	8½″ x 11″ white paper	9
5 reams	1 ream	8½″ x 11″ tracing paper	21
125 sheets	25 sheets	12″ x 18″ tracing paper	146
1 ream	100 sheets	12″ x 18″ grid paper, ¼″ x ¼″ grid	145
125 sheets	25 sheets	12″ x 18″ grid paper, ⅛″ x ⅛″ grid	151
1 ream	100 sheets	8½″ x 11″ grid paper, ¼″ x ¼″ grid	142
25 sheets	5 sheets	12″ x 18″ poster board	111
25	5	9″ x 11⅞″ manila file folders	21
250	50	3″ x 5″ index cards blank	92
10	10	Felt markers of 5 colors	6
2	1	Transparency marker (grease pen)	5
25	25	2 H pencils	31
25	25	4 H pencils	31
25	25	Erasers	31
5	5	Crayon, black lumber	100
1 box	1 box	Thumb tacks	102
3 boxes	1 box	Paper clips	21
5 rolls	5 rolls	¾″ masking tape	26
5	1	Ball of string (100′)	11

Finishing Materials

12 tubes	12 tubes of different colors	Coloring for exterior latex paint	125
5 gals.	1 gal.	Latex base paint, exterior white	125
7 gals.	1 gal.	Latex base paint, interior white	125
1 gal.	1 qt.	Clear shellac	124
1 gal.	1 qt.	Mineral spirits	124
1 gal.	1 qt.	Alcohol	124
1 can	1 can	Putty	124
1 tube	1 tube	Caulking compound	124

Landscaping Materials

5	1	Small trees or shrub	129
120 lbs.	20 lbs.	Peat moss	129
50 lbs.	10 lbs.	"10-6-4" fertilizer	129
10	2	10″ x 2″ x 6′ stakes	129
10′	2′	Garden hose	129
30′	6′	Wire (stove pipe type)	129

Model Materials

35 sheets	7 sheets	¼″ x 4′ x 4′ urethane foam sheet	157
50 sheets	10 sheets	Plastic window material	167
125 sheets	25 sheets	Exterior veneers (wood, stone, brick, roofing)	168
125 sheets	25 sheets	18″ x 24″ or 12″ x 18″ green construction paper	170
125 sheets	25 sheets	Construction paper (asst. colors 9″ x 12″)	56

(Per Teacher) Per 5 Classes	(25 Students) Per Class	Items	Assignment First Used
125 sheets	25 sheets	Black construction paper, 9″ x 12″	171
10 boxes	2 boxes	Lichen (for trees and shrubs)	171
5 boxes	900	Straight pins	158
50 sheets	10 sheets	Extra fine (8/0) abrasive paper	156
125 sheets	25 sheets	Medium (1/0) abrasive paper	118
250	50	8 oz. paper cups (paint containers)	15
8 lbs.	1 lb.	Paint (tempera) variety of colors	165
1 can	1 can	Brush cleaner	165
50	50	Stirring sticks for tempera paint	165
25	5	16 oz. paper cups	73
Metals			
25 pcs.	5 pcs.	50″ galv. drip edge (optional)	107
25 pcs.	5 pcs.	24″ galv. rake edge (optional)	107
25 sheets	5 sheets	28 ga. x 5″ x 27¾″ galv. (*or* equiv.) sheet metal	94
25 sheets	5 sheets	28 ga. x 4″ x 13½″ galv. (*or* equiv.) sheet metal	94
25 sheets	5 sheets	28 ga. x 5″ x 13″ galv. (*or* equiv.) sheet metal	94
25 sheets	5 sheets	20 ga. x 6″ x 16″ galv. (*or* alum.) flashings	110
50 pcs.	10 pcs.	3″ x 14″ corrugated metal strips (optional)	15
5 pcs.	5 pcs.	2″ x 16″ sheet metal strips	69
2	2	4″ x 10″ sheet metal (any gage)	115
100′	20′	⅜″ steel reinforcement rod (*or* equiv.)	72
50 pcs.	10 pcs.	10″ coat hanger wire (*or* equiv.)	72
150′	30′	16 gauge black iron wire	72
1	1	Shims (scrap)	79
Concrete and Masonry Materials			
125	36	2¼″ x 3¾″ x 8″ common face bricks	15
30	25	8″ x 8″ x 16″ concrete block	25
12	10	8″ x 8″ x 8″ concrete block	76
3 bags	1 bag	80 lb. bag mortar *or* ready mix mortar	77
5 bags	1 bag	80 lb. bag cement	73
20 bags	4 bags	100 lb. bag sand	15
20 bags	4 bags	100 lb. bag coarse aggregate (pea gravel)	73
Electrical			
25	5	4″ electrical octagonal outlet box	100
25	5	22⅜″ adjustable bar hanger	100
25	5	Duplex outlet box for ½″ conduit	100
25	5	Switch box w/loom clamp and bracket	100
85′	17′	½″ x 40″ thin wall conduit (EMT)	101
25	5	½″ EMT box connector	101
25	5	½″ EMT hanger	101
150′	30′	6′ 0″ lgth. No. 12 T. W. wire (white)*	101
150′	30′	6′ 0″ lgth. No. 12 T. W. wire (black)*	101
150′	30′	6′ 0″ lgth. No. 12 T. W. wire (green)*	101
125′	25′	5′ 0″ lgth. No. 12/2 w/ground flex. armored cable (BX)*	101
25	5	Armored cable (BX) box connectors for ⅜″ cable	101
25	5	Insulating bushings for ⅜″ BX cable	101

(Per Teacher) Per 5 Classes	(25 Students) Per Class	Item	Assignment First Used
25	5	⅜″ armored cable staples	101
150′	30′	6′ 0″ lgth. No. 12/2 w/ground non-metallic sheathed cable (Romex)	101
25	5	2″ Romex staples	101
25	5	Parallel ground duplex receptacle w/cover plate	127
25	5	Single pole toggle switch w/cover plate	127
25	5	Keyless procelain lamp receptacle	127
25	5	Solderless connector for No. 12 wire (wirenuts)	127
25	5	Male plug 3-prong	128
50	10	Metal ground clips	127

*See Laboratory Activity Note in Assignment 101.

Roof, Wall, Floor, Ceiling Materials

450	90	12″ x 36″ asphalt shingles	107
25	5	52¼″ starter strip (shingles)	107
6 rolls	1 roll	15 lb. building felt	70
100′	20′	2″ x 14½″ roll blanket insulation	115
25 shts.	5 shts.	⅜″ x 4′ x 4′ gypsum board	116
5 pkgs.	1 pkg.	Joint treatment cement	117
1 roll	1 roll	Joint tape	117
160 lbs.	40 lbs.	Mill mixed gypsum plastic (optional)	119
10 shts.	2 shts.	⅜″ x 16″ x 48″ rock lath (optional)	119
100-50	20-10	12″ x 12″ *or* 24″ acoustical ceiling tile	120
100 sq. ft.	20 sq. ft.	Vinyl floor tile	121
3 qts.	1 qt.	Floor tile mastic	121

Fasteners

2 gross	30	No. 8 x ½″ sheet metal screws	94
1 gross	10	No. 8 x ¾″ flathead screws	98
15 lbs.	3 lbs.	6d common nails	56
10 lbs.	1 lb.	8d common nails	69
10 lbs.	1 lb.	16d common nails	84
10 lbs.	1 lb.	6d box nails	60
5 lbs.	1 lb.	8d box nails	84
10 lbs.	2 lbs.	½″ No. 18 roofing nails	107
10 lbs.	2 lbs.	Rock lath nails	116
10 lbs.	2 lbs.	4d finishing nails	11
10 lbs.	2 lbs.	8d finishing nails	108
2 pts.	1 pt.	Rubber cement	156
2 gals.	5 btls.	White glue	156
3 boxes	1 box	¼″ staples	38
2 boxes	1 box	9/16″ staples for staple gun	107
8	8	½″ x 6″ square head bolts w/nuts, washers	73

Plumbing Supplies

25	5	½″ x 3″ galv. pipe*	97
25	5	½″ galv. dropeared elbow	97
25	5	½″ 90° galv. elbow	97
50	10	½″ galv. pipe clamp	98
25	5	½″ x 14″ type "L" hard copper tubing*	98
25	5	½″ F.I.P. copper dropeared elbow	98
1 can	1 can	Pipe dope w/brush (½ pint)	97

(Per Teacher) Per 5 Classes	(25 Students) Per Class	Item	Assignment First Used
1 qt.	1 qt.	Cutting oil	97
5 lb.	1 lb.	50-50 solder	98
1 can	1 can	Soldering flux w/brush	98
5 pads	5 pads	Steel wool	98
5	5	1″ ring of 2″ diameter pipe	26

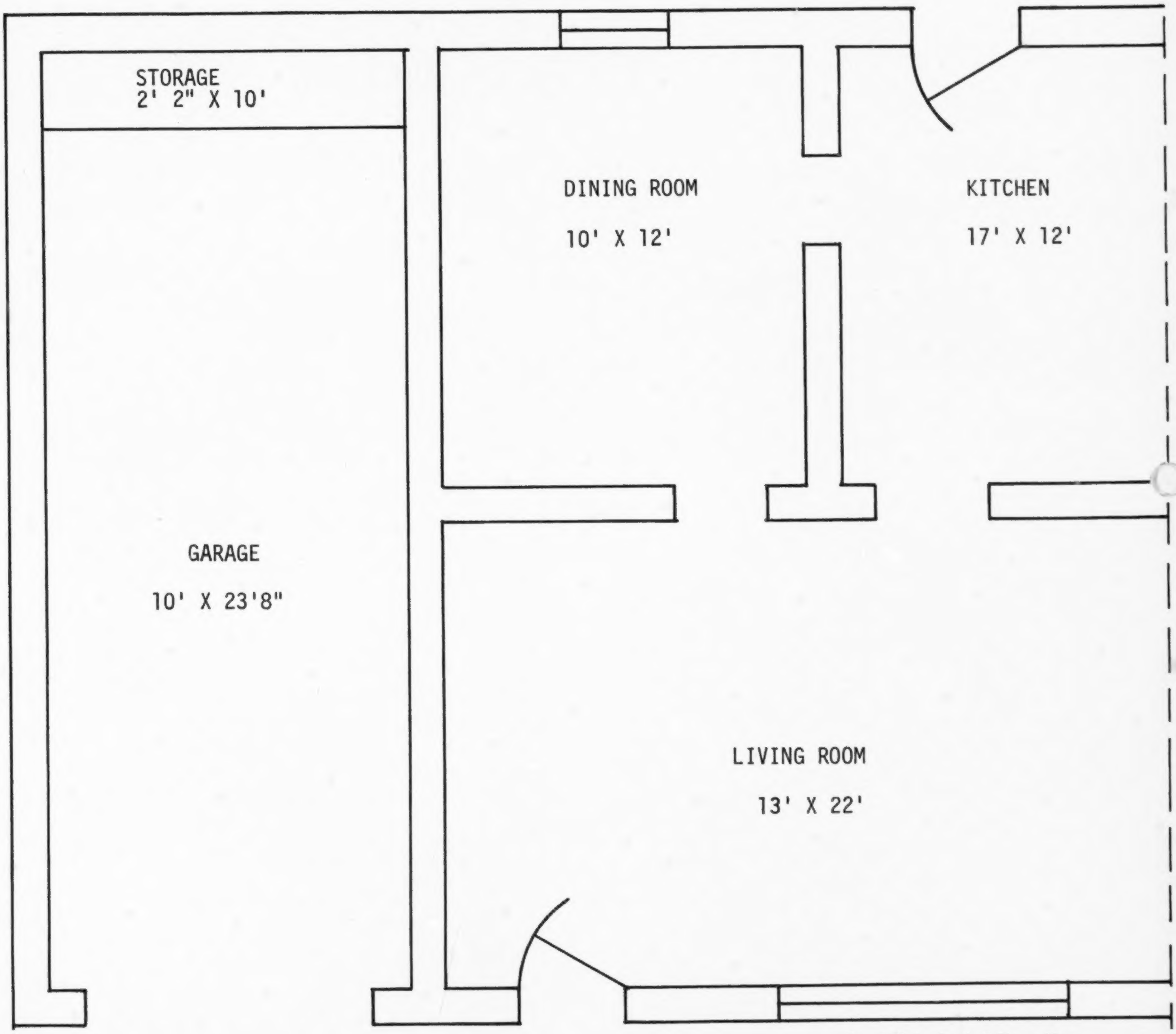
*See Laboratory Activity Note in Assignments 97, 98.

Miscellaneous

5	5	Sponges (2″ x 6″ x 10″) *or* (2″ x 4″ x 6″)	16
4 qts.	1 qt.	Liquid detergent	125
30	30	Rags	72
2 qts.	1 qt.	30 W motor oil	72
1 roll	1 roll	Paper towels	15
50	10	½ gal. milk cartons (waxed or plastic-coated)	15
5	5	3″ funnels (plastic)	15
5	5	Small cardboard boxes	56
1 roll	1 roll	Aluminum foil	56
2	2	Paper towel roll	56
6	6	Small rocks, stones	56
50	10	1 lb. coffee cans	16
5	5	60 W light bulb	128
10 gals.	8 gals.	Clay (earth)	15
1 spl.	1 spl.	Thread	26

Wood and Composition Materials

13 pcs.	3 pcs.	2″ x 6″ x 8′ common lumber	25
235 pcs.	47 pcs.	2″ x 4″ x 8′ common lumber	25
25 pcs.	5 pcs.	1″ x 6″ x 10′ common lumber	69
75 pcs.	15 pcs.	1″ x 4″ x 8′ common lumber	25
50 pcs.	10 pcs.	1″ x 3″ x 8′ common lumber	56
25 pcs.	5 pcs.	1″ x 2″ x 8′ common lumber	26
15 pcs.	3 pcs.	1″ x 6″ x 8′ V joint (T & G) vertical siding, Min. 4′	109
25 pcs.	5 pcs.	½″ x 2¼″ x 8′ tear drop casing (clamshell)	122
25 pcs.	5 pcs.	½″ x 2¼″ x 6′ baseboard (clamshell)	123
25 pcs.	5 pcs.	½″ x ¾″ x 6′ base shoe	123
25 pcs.	5 pcs.	¾″ x ¾″ x 6′ cove molding	123
75 pcs.	15 pcs.	¼″ x 12″ x 8′ clapboard siding (beveled) *or* (equiv. e.g. ¼″ asbestos, ¼″ hardboard *or* ¾″ x 12″ x 4′ lumber)	112
2 shts.	1 sht.	¼″ x 4′ x 8′ exterior plywood	69
5 shts.	1 sht.	⅜″ *or* ¼″ x 4′ x 8′ plywood paneling	116
16 shts.	4 shts.	½″ x 4′ x 8′ C.D. plywood sheathing	11
25 shts.	5 shts.	½″ x 4′ x 8′ composition sheathing (*or* equiv.)	106
5 shts.	1 sht.	¾″ x 4′ x 4′ insulation board (*or* equiv.)	175
25 shts.	5 shts.	⅛″ x 4′ x 8′ fiberboard (*or* hardboard equiv.)	156
		wood scraps	16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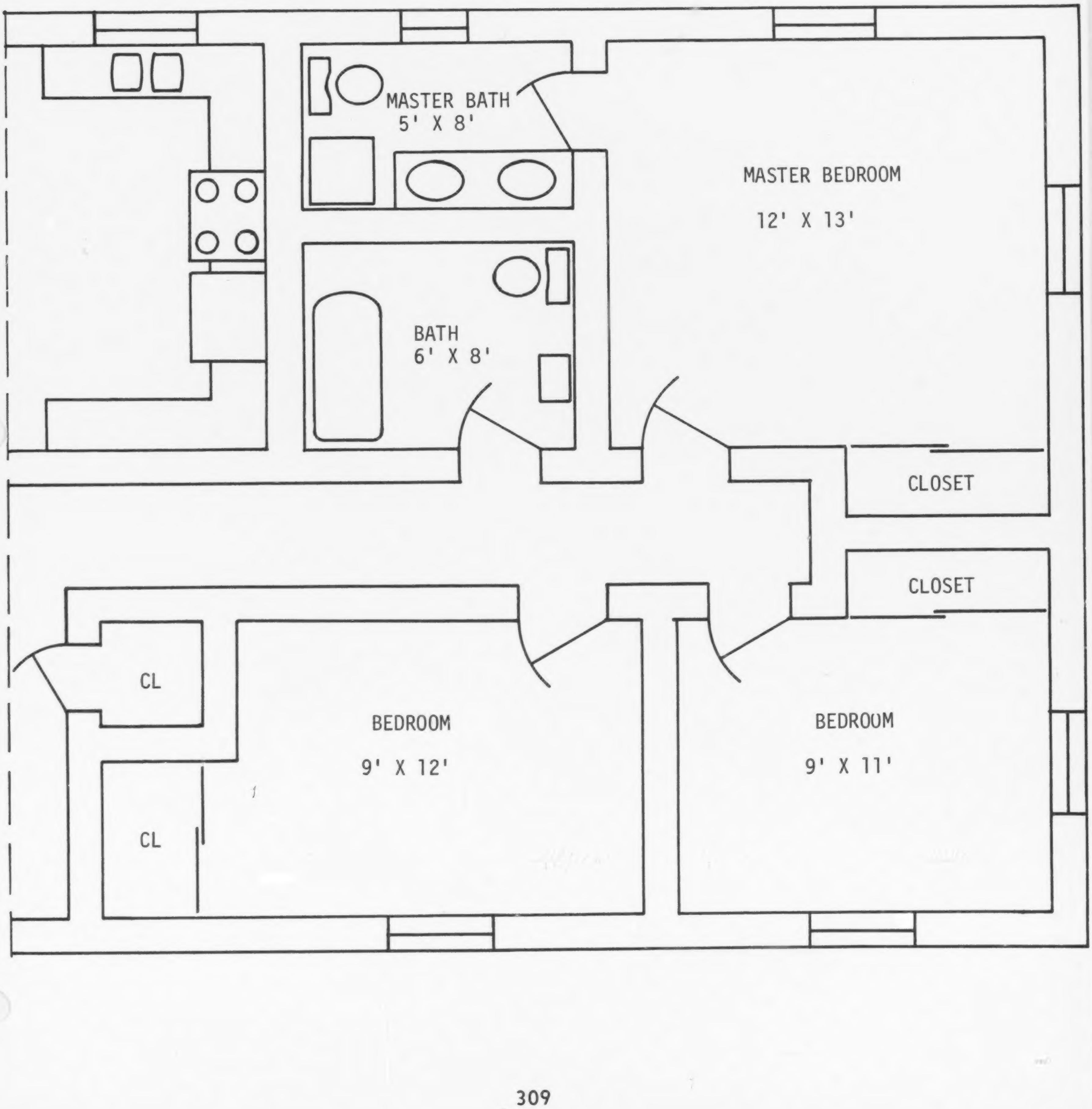
2' 2" X 10'
DINING ROOM
10' X 12'
KITCHEN
17' X 12'
GARAGE
10' X 23'8"
LIVING ROOM
13' X 22'

Fig. 142-1. Scaled Floor Plan


MASTER BATH
5' X 8'
MASTER BEDROOM
12' X 13'
BATH
6' X 8'
CLOSET
CLOSET
CL
CL
BEDROOM
9' X 12'
BEDROOM
9' X 11'